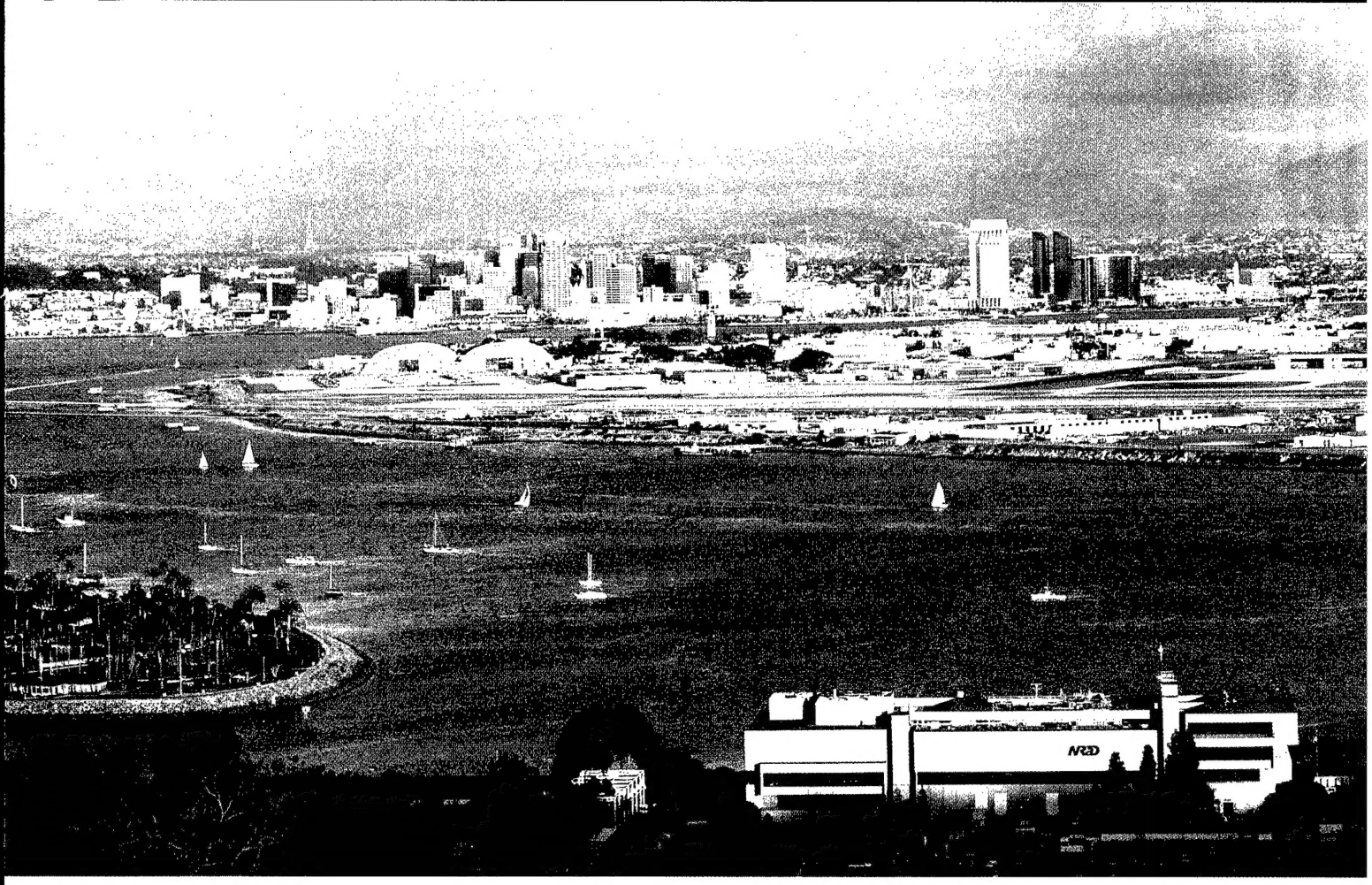

Technical Document 2897
February 1996

Natural Resources Management Plan for Naval Submarine Base, San Diego

Volume 1: Appendices A–K

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Marine Environmental Support Office
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NAVAL COMMAND, CONTROL AND OCEAN SURVEILLANCE CENTER RDT&E DIVISION San Diego, California 92152-5001

K. E. EVANS, CAPT, USN
Commanding Officer

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Executive Director

ADMINISTRATIVE INFORMATION

The work detailed in this report was performed for Naval Submarine Base, San Diego, CA, by the Naval Command, Control and Ocean Surveillance Center RDT&E Division, Computer Sciences Corporation, and the San Diego State University Foundation.

Released by
S. J. Harrell, Head
Marine Environmental
Support Office

Under authority of
R. H. Moore, Head
Environmental Quality
Division

Volume 1: Appendixes A - K

Appendix A- Naval Submarine Base, San Diego CA (SUBASE) Facility Location Maps

Appendix B- SUBASE Natural Resource Maps and Species Lists (Birds, Insects, Plants, and Reptiles)

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Appendix D- SUBASE Non-native Plant Maps, 1995

Appendix E- White House Memo of 26 April 1994: Landscaping with native plants on federal grounds and federal projects.

Appendix F- Arborist's Report on Tree Growing for Heron Mitigation Habit, 1994

Appendix G- Plant List for Restoration and Revegetation

Appendix H- Erosion Control, Wattling and Cellular Confinement System Specifications

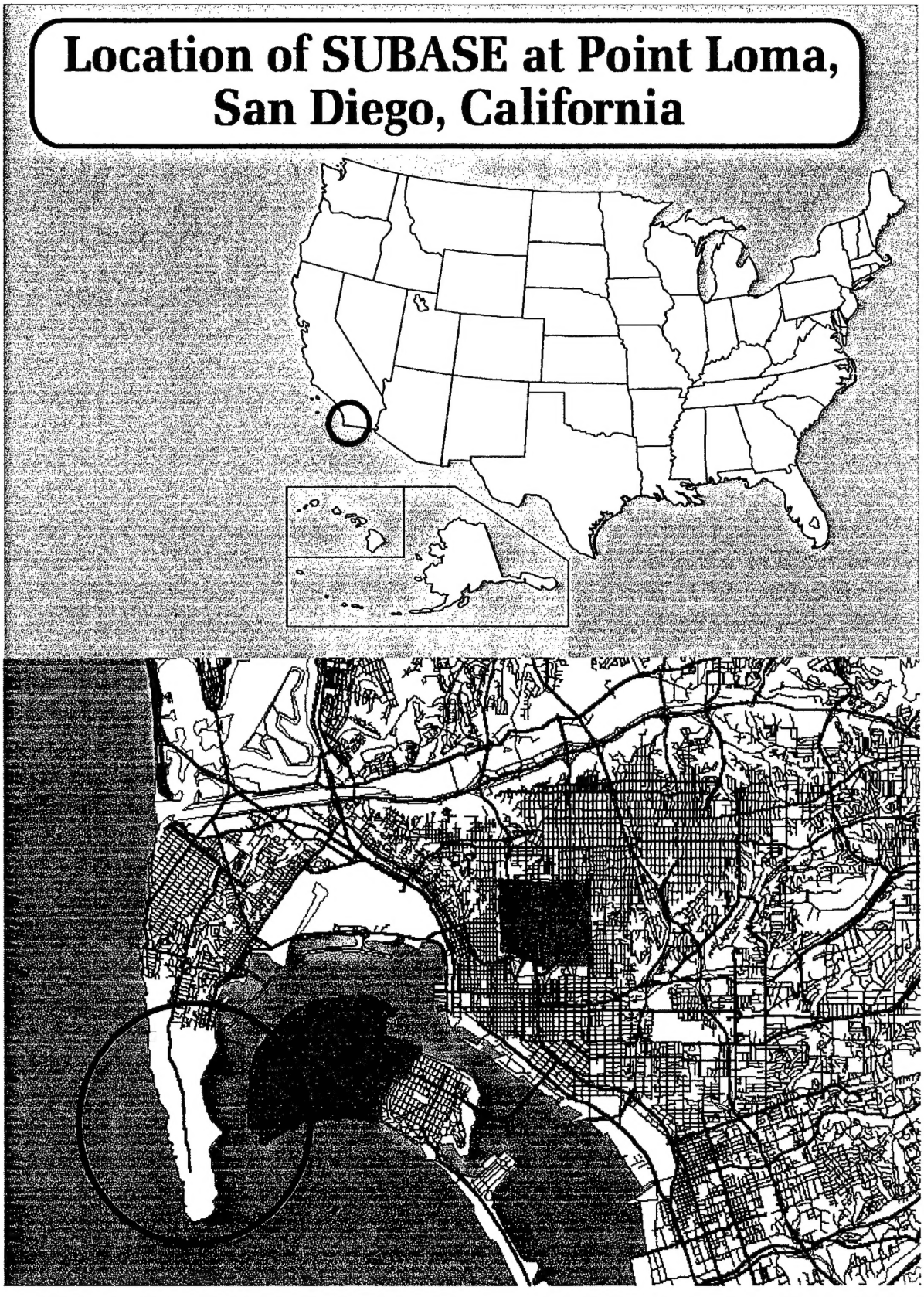
Appendix I- 1980 Nesting Success of Great Blue Herons on Point Loma, San Diego, California

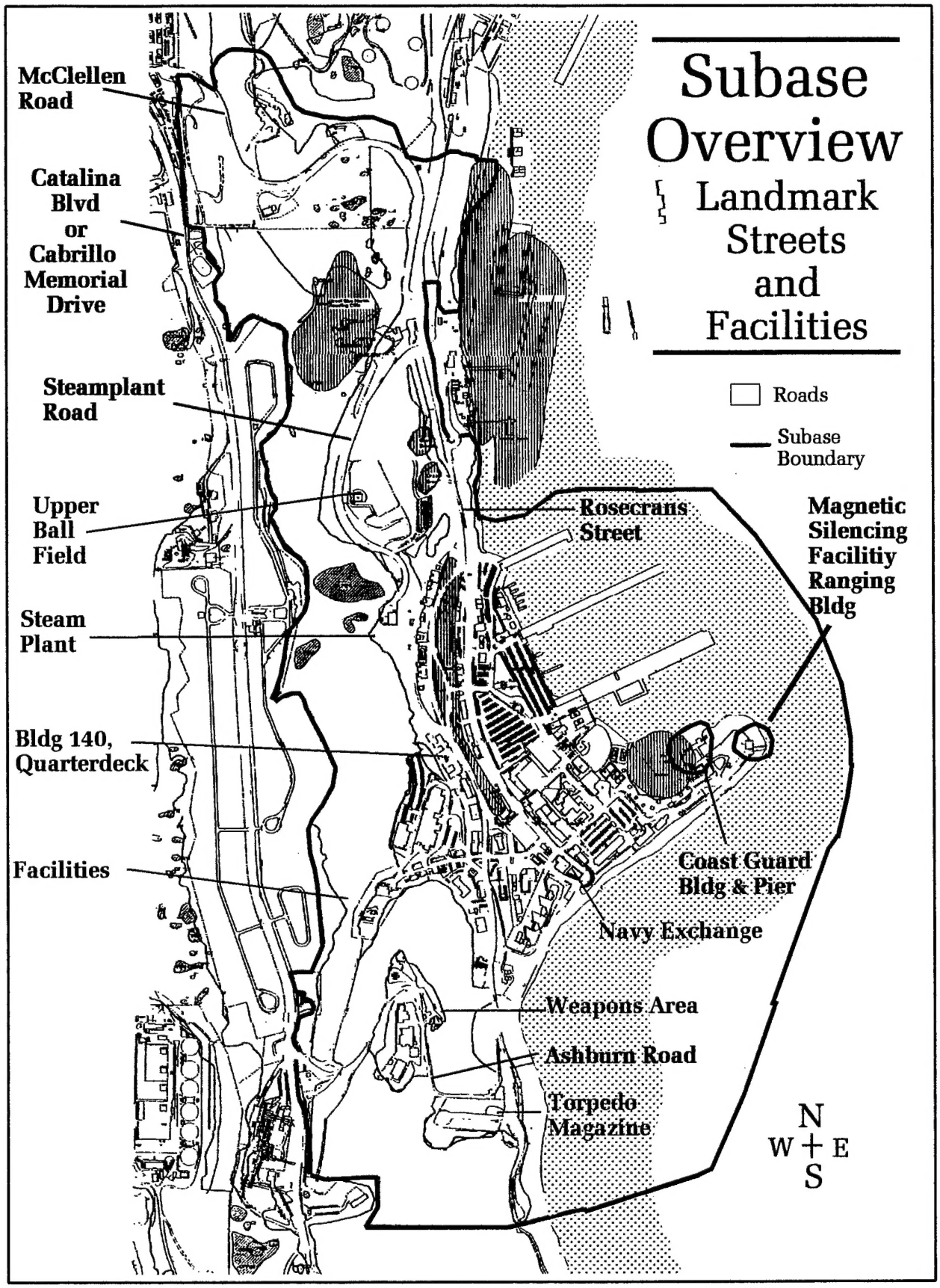
Appendix J- Great Blue Heron and Black-crowned Night Heron Nesting Success, 1991-1996

Appendix K- Heron Management Plan for Naval Submarine Base San Diego, 1995

Appendix A- Naval Submarine Base, San Diego CA (SUBASE) Facility Location Maps

Location of SUBASE at Point Loma, San Diego, California




Subase Overview
Landmark Streets and Facilities
Roads
Subase Boundary
McClellen Road
Catalina Blvd or Cabrillo Memorial Drive
Steamplant Road
Upper Ball Field
Steam Plant
Bldg 140, Quarterdeck
Facilities
Rosecrans Street
Magnetic Silencing Facilitiy Ranging Bldg
Coast Guard Bldg & Pier
Navy Exchange
Weapons Area
Ashburn Road
Torpedo Magazine
N
W
E
S

Appendix B- SUBASE Natural Resource Maps and Species Lists (Birds, Insects, Plants, and Reptiles)

SUBASE Natural Resource Maps

The following ten basic, black and white maps are taken from the Terrestrial Biological Survey and Inventory of Navy Property on Point Loma, San Diego, California, 1993 (Appendix M in Volume 2 of this report), for consistency in showing locations. They were then modified and enhanced to document visually information that I have acquired about common and sensitive natural resources that is not available elsewhere. I reduced the basic black and white maps to an eight by ten paper for ease of handling; colored the major roads yellow for ease of quick location on the maps; and indicated SUBASE'S boundaries with a bright red line. It takes five maps to cover Subase, from north to south. To eliminate clutter, all animal sightings are on their own five maps, as are all the plant sightings. Again, these maps are not intended to be absolutely complete, but to document all sightings that I am aware of since the Terrestrial Survey in 1993, and to make important data generally available.

All the animals located on the maps are natives; in addition the great blue heron, black-crowned night heron, and western gull are protected under the International Migratory Bird Treaty Act. The orange-throated whiptail lizard is a sensitive species (candidate category 2), as is the western mastiff bat; and the presence of coyotes and especially bobcats are indicative of the high habitat value of the Point Loma wildlands. The fact that all of the above mentioned animals, except the mastiff bat, breed successfully on Subase, or on Point Loma, is also indicative of the high habitat values found on the Point. This sensitive and important bat is capable of flying a feeding route of greater than fifty miles every night, and has been frequently heard feeding above Subase and the Fort Rosecrans Cemetery. In December 1996, the Coast Guard recovered a dead western mastiff bat from a channel buoy in San Diego Bay; the corpse confirmed the aural sightings.

All plants located on the five plant maps are natives. *Opuntia parryi* var *serpentina* (snake cholla), *Quercus dumosa* (scrub oak), *Ceanothus verrucosus* (wartystem ceanothus), and *Ferocactus viridescens* (coast barrel cactus) are sensitive plants (candidate category 2). *Zigadenus fremonti* (star lily), *Coreopsis maritima* (sea dahlia), *Rhamnus crocea* (spiny redberry), and *Stipa coronata* (giant stipa, a large bunch grass) are interesting native plants that are fairly rare on Subase. One must know one's natural resources well, because unfortunately for all of us, the list of endangered, threatened, or potentially endangered species increases every year.

The major cause of species losses is direct habitat loss, which is particularly obvious in San Diego where the habitat known as Coastal Sage Scrub (CSS) was so common it was not even studied more than fifty years ago; now only scattered remnants are left. Of course all the plants and animals that lived in CSS are now also gone, or becoming scarce. Recent human history has shown clearly that resources that were common as dirt yesterday may well become tomorrow's vanishing or vanished item.

Biological diversity is vitally important to all humans because we depend, at a very basic level, on the ability of this planet to recycle, filter, and clean the water we drink and the air we breath, as well as providing the foodstuffs we eat every day. Diversity is just one simple way of attempting to catagorize and understand the web of life that supports humans, as well as all other living beings, on this planet. The Point Loma Wildlands or Reserve are a vitally important link in saving some of this biological diversity because not only are these ecosystems still fairly intact and functioning (as judged from the species still living on the Point), they are present in a large enough habitat fragment to have real hope of surviving as intact ecosystems for more that one hundred years. Island biogeography has clearly shown that the smaller the habitat fragment, the faster species will inevitably go extinct, and in greater numbers. Point Loma is also lucky enough to have the Pacific Ocean as a buffer on two sides, San Diego Bay on the third side, and the presence of the Federal Enclave to hold off urbanization on the fourth side.

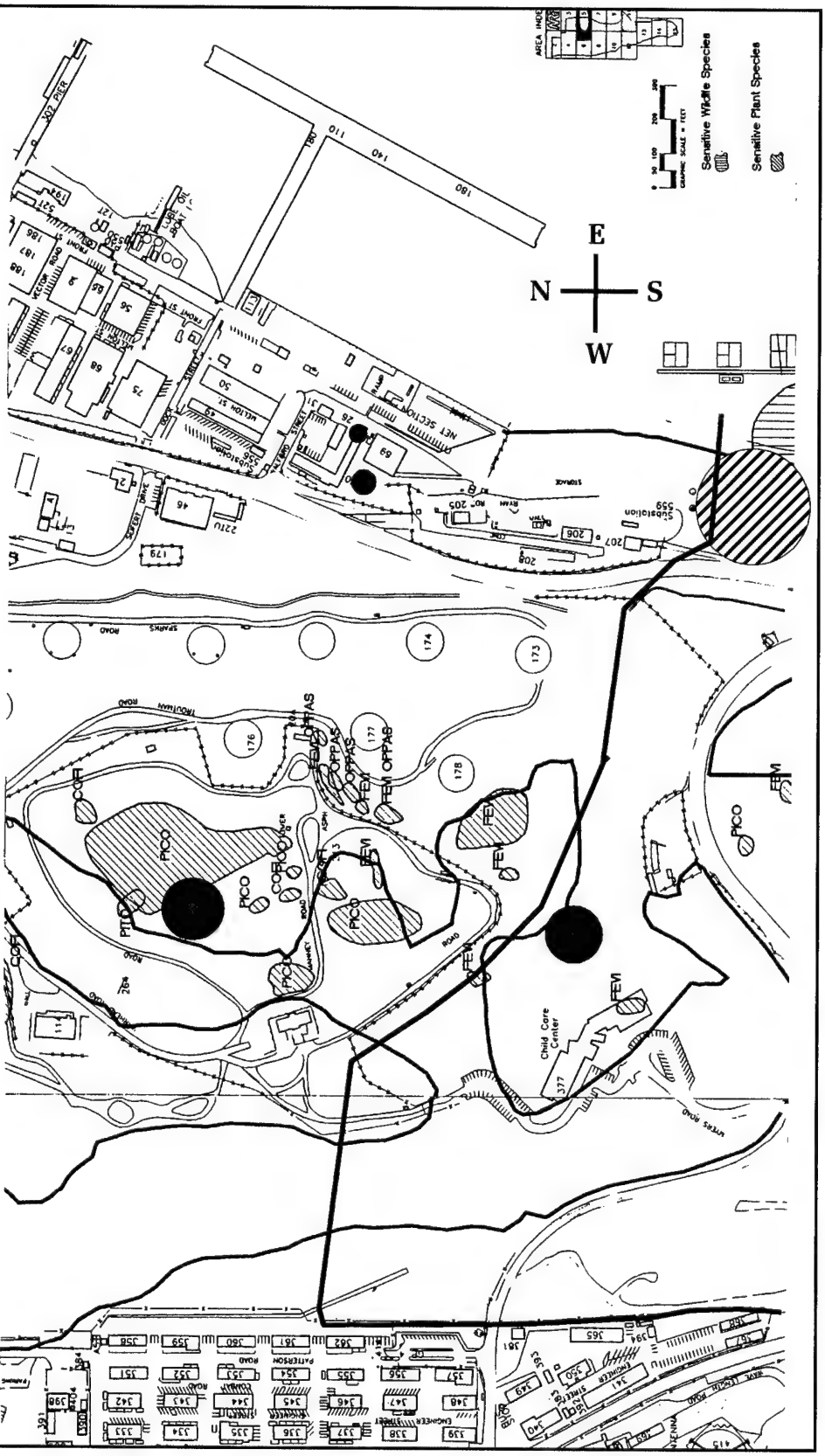
Subase can be extremely proud of the large share of the Point Loma wildlands existing within its boundaries, and of the generally good condition that they show. These ecosystems are a critically important legacy from Subase to all of our children and their children's children.

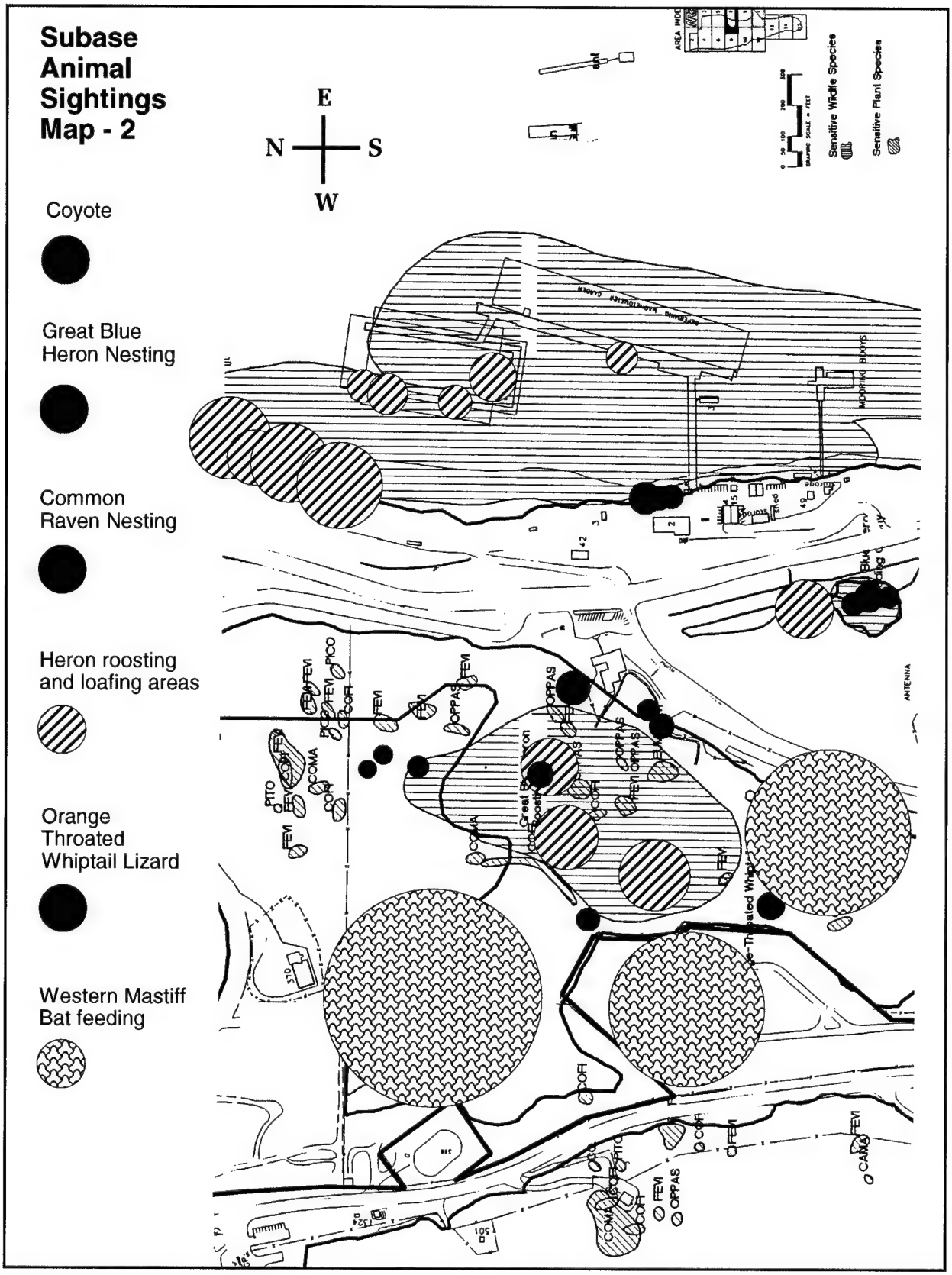
Subase Animal Sightings Map - 1

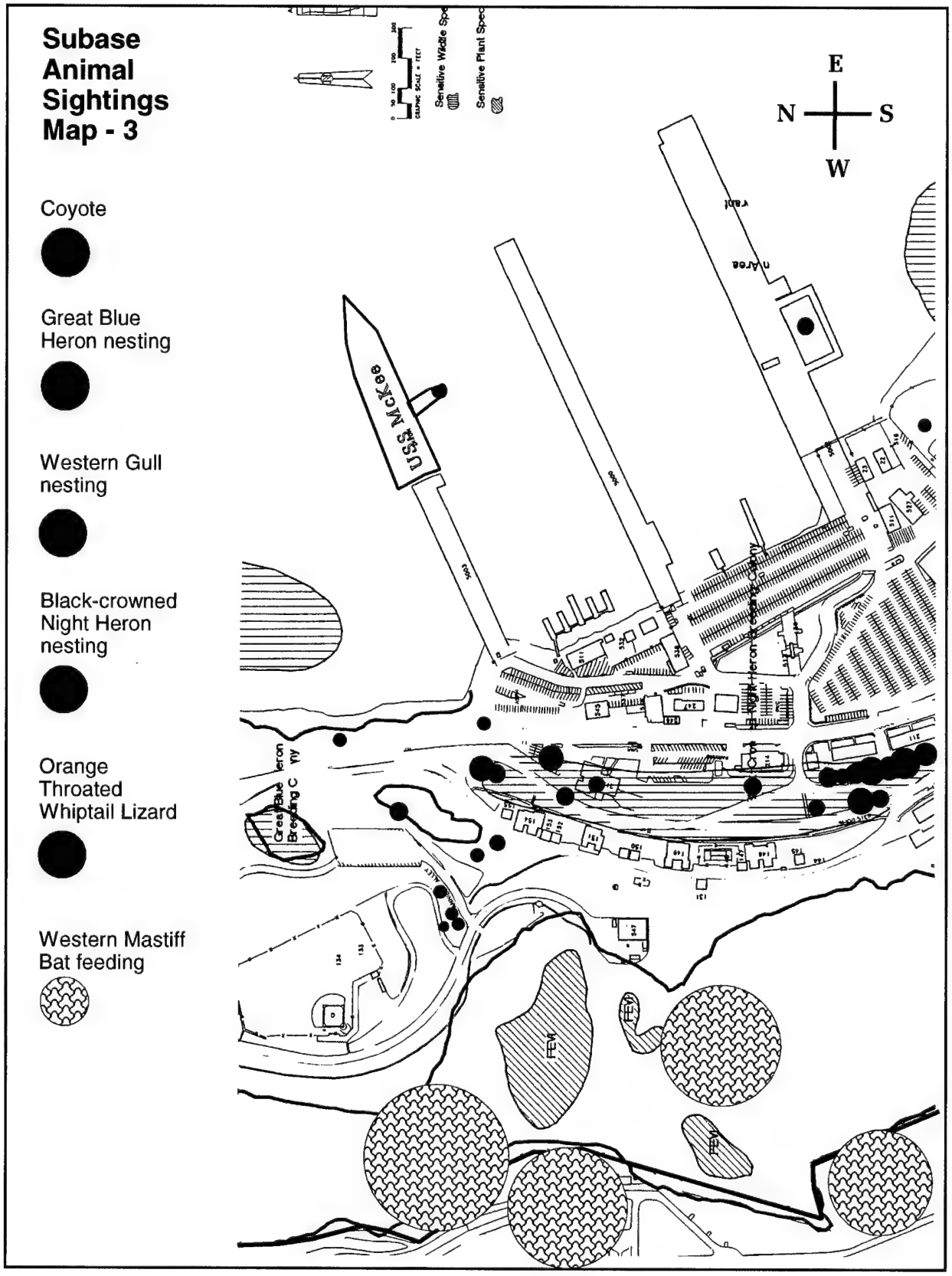
Coyote

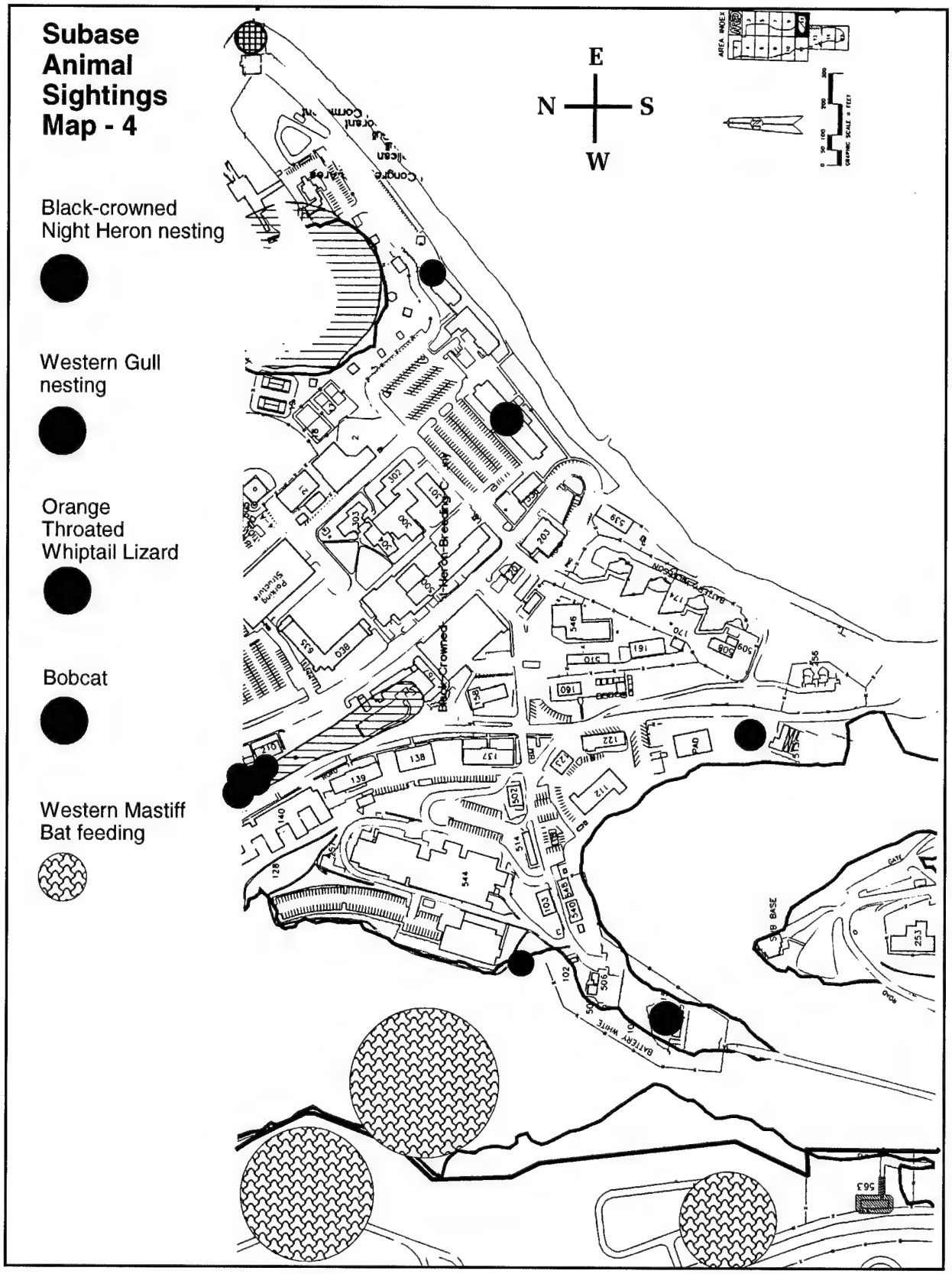
Great Blue Heron Nesting

Western Gull Nesting




Subase
Animal
Sightings
Map - 2
E
N
S
W
Coyote
Great Blue
Heron Nesting
Common
Raven Nesting
Heron roosting
and loafing areas
Orange
Throated
Whiptail Lizard
Western Mastiff
Bat feeding
Sensitive Wildlife Species
Sensitive Plant Species
MORNING BUOYS
ANTENNA
Great Blue Heron Roost
Orange-Throated Whiptail
FEVI
OPPAS
COFI
COMA
PITO
CAMO
PICO


Subase
Animal
Sightings
Map - 3
Coyote
Great Blue
Heron nesting
Western Gull
nesting
Black-crowned
Night Heron
nesting
Orange
Throated
Whiptail Lizard
Western Mastiff
Bat feeding
E
N
S
W
USS McKee
FEM


Subase
Animal
Sightings
Map - 4
Black-crowned
Night Heron nesting
Western Gull
nesting
Orange
Throated
Whiptail Lizard
Bobcat
Western Mastiff
Bat feeding
E
N
S
W
Black-Crowned Night Heron Breeding
SUB BASE
BATTERY WHITE

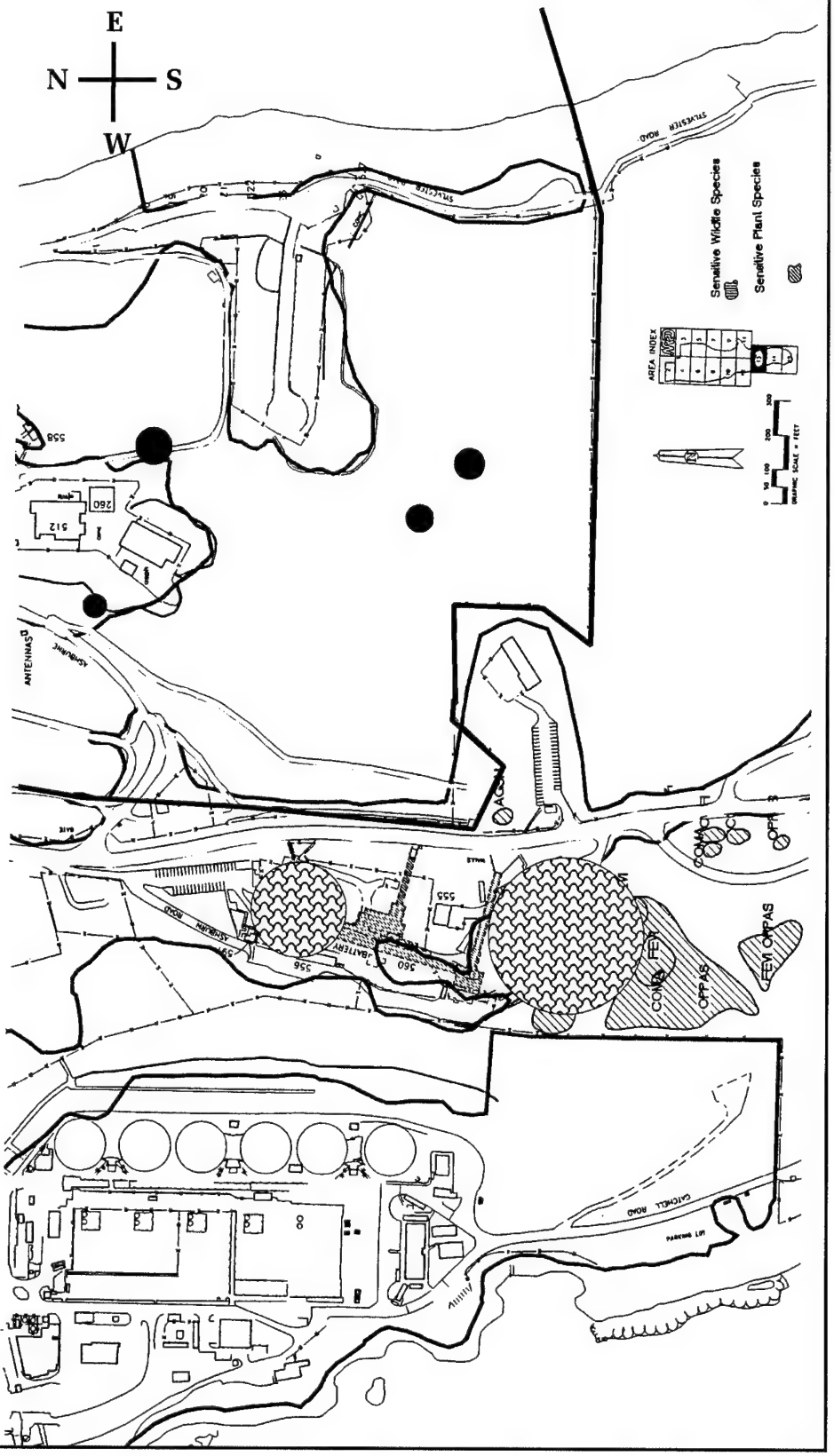
Subase Animal Sightings Map - 5

Coyote

Orange Throated Whiptail Lizard

Bobcat

Western Mastiff Bat feeding

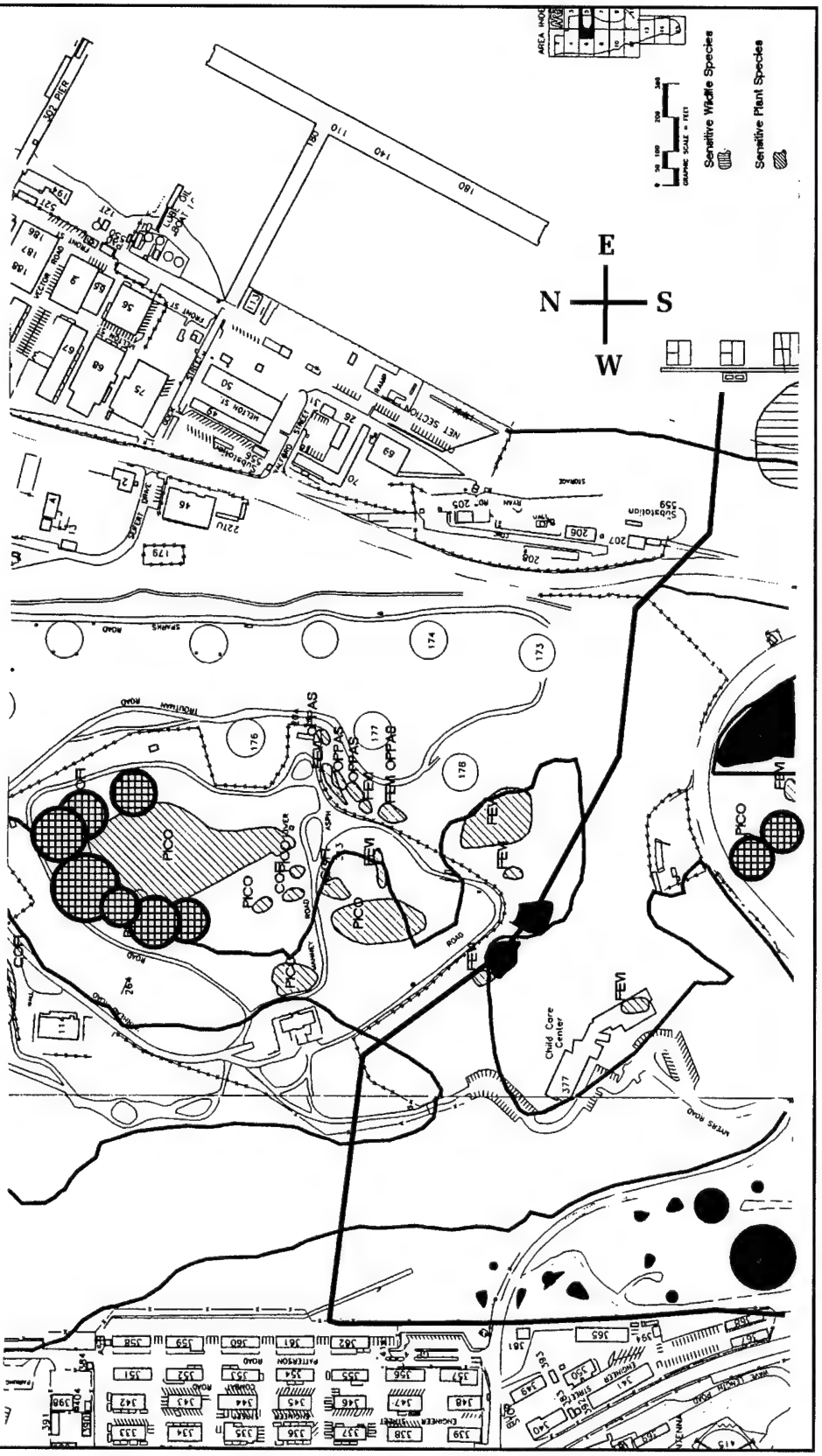


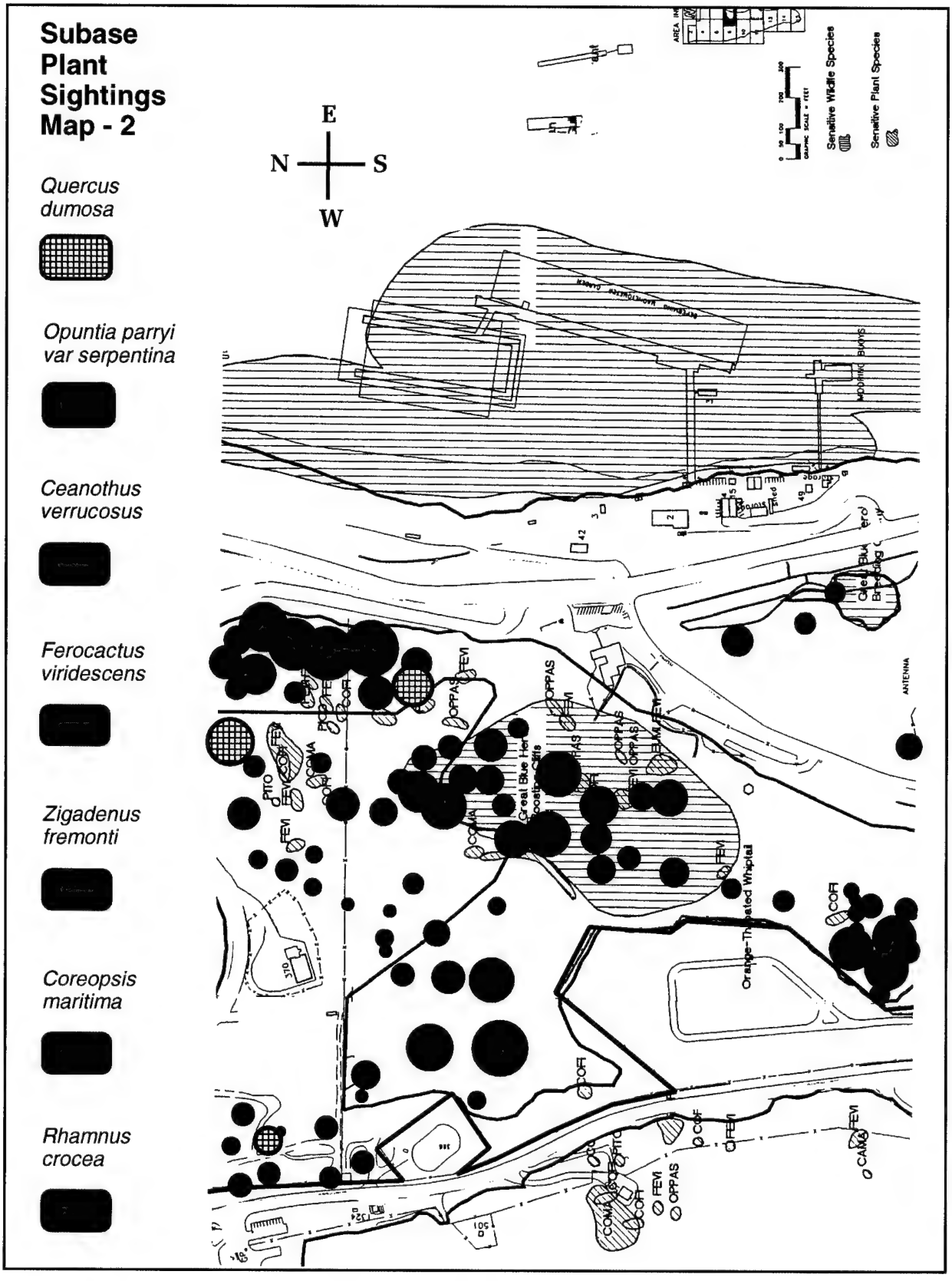
Subase Plant Sightings Map - 1

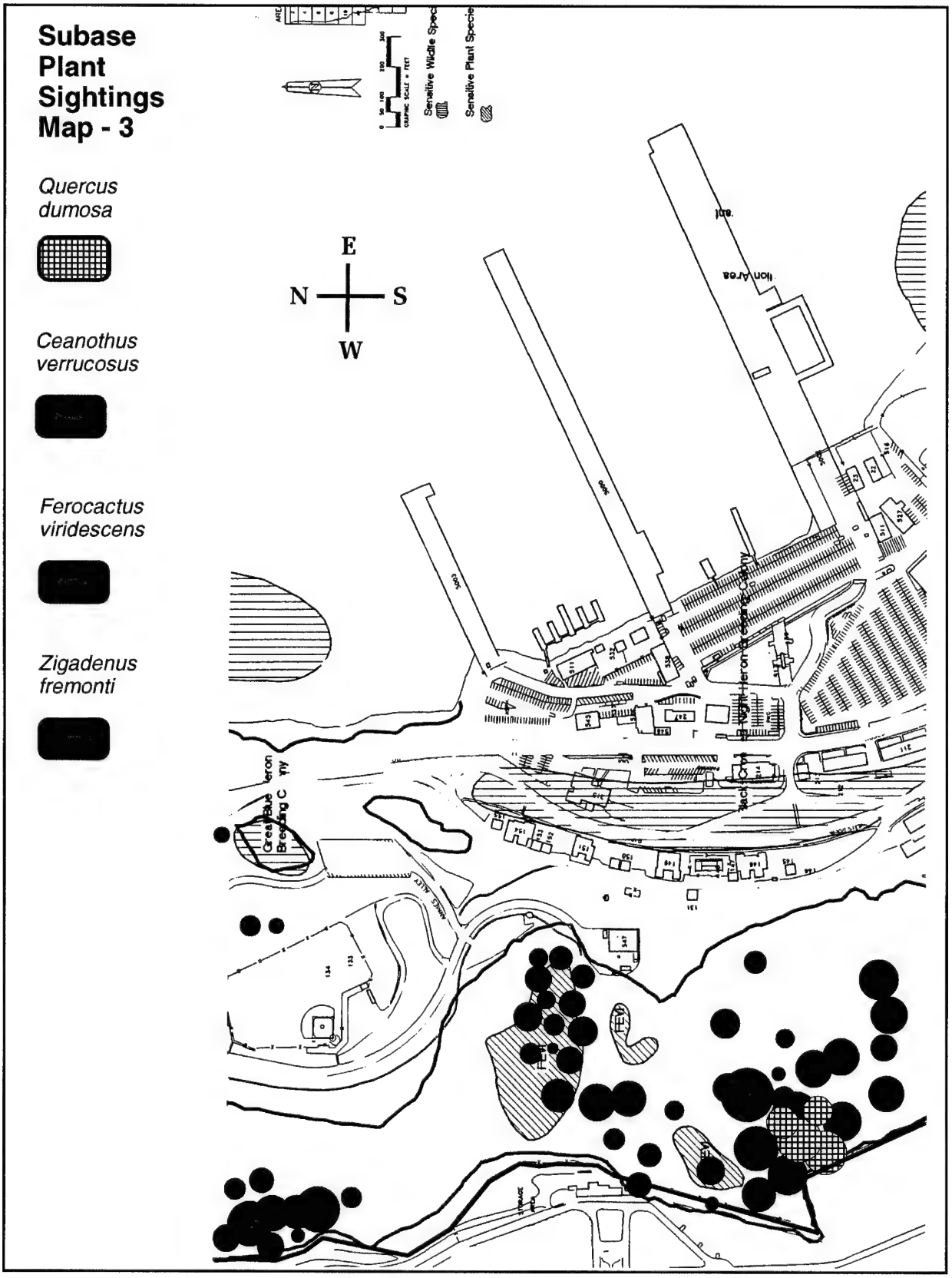
Quercus dumosa

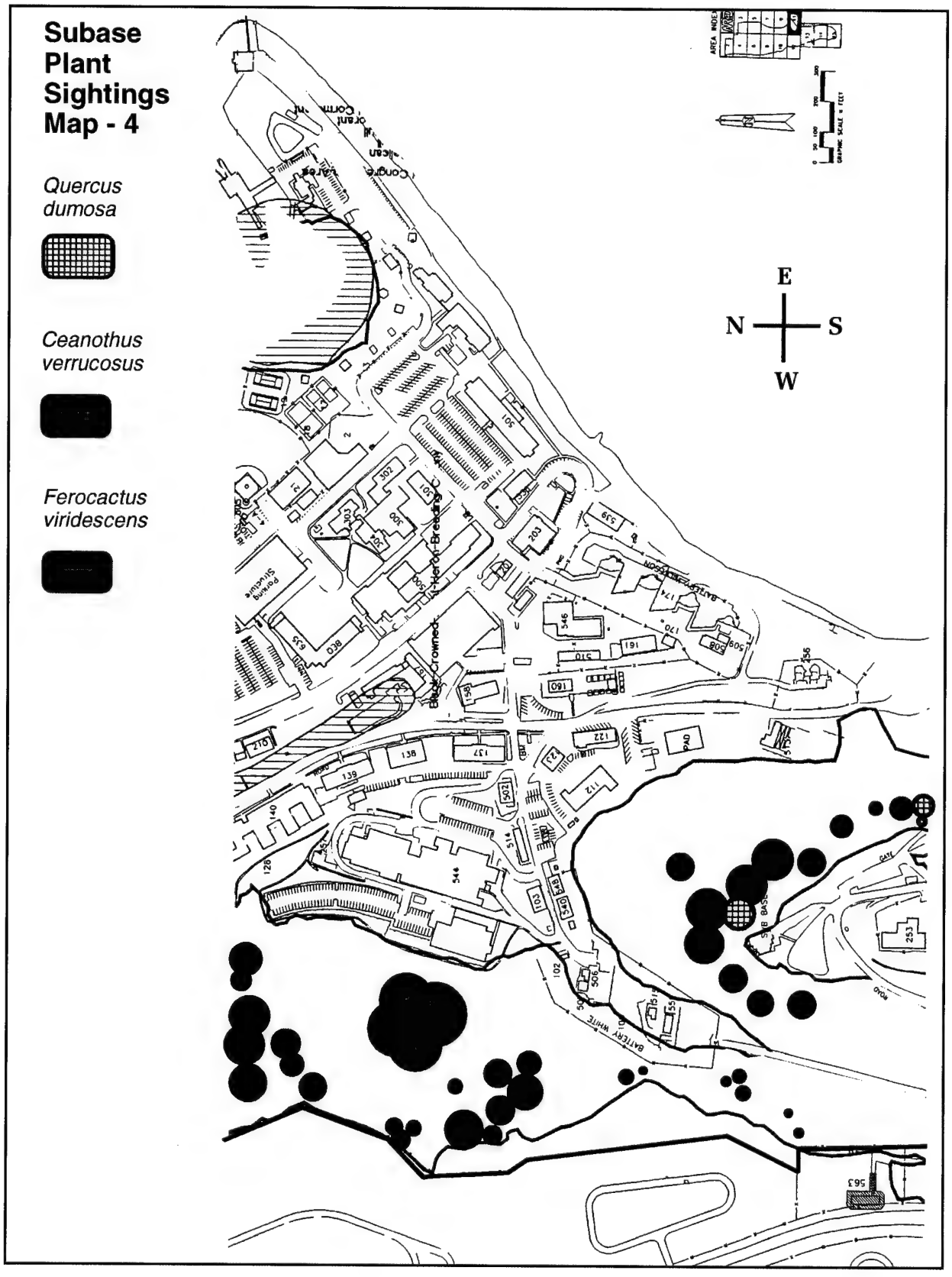
Opuntia parryi var serpentina

Ceanothus verrucosus




Subase
Plant
Sightings
Map - 2
Quercus dumosa
Opuntia parryi var serpentina
Ceanothus verrucosus
Ferocactus viridescens
Zigadenus fremonti
Coreopsis maritima
Rhamnus crocea
E
N
S
W
Sensitive Wildlife Species
Sensitive Plant Species
Great Blue Heron Roosting Site
Orange-Throated Whiptail
ANTENNA
COR
FEM
OPPAS
COMA
CAMA


Subase
Plant
Sightings
Map - 3
Quercus
dumosa
Ceanothus
verrucosus
Ferocactus
viridescens
Zigadenus
fremonti
E
N
S
W


Subase
Plant
Sightings
Map - 4
Quercus
dumosa
Ceanothus
verrucosus
Ferocactus
viridescens
E
N
S
W

Subase Plant Sightings Map - 5

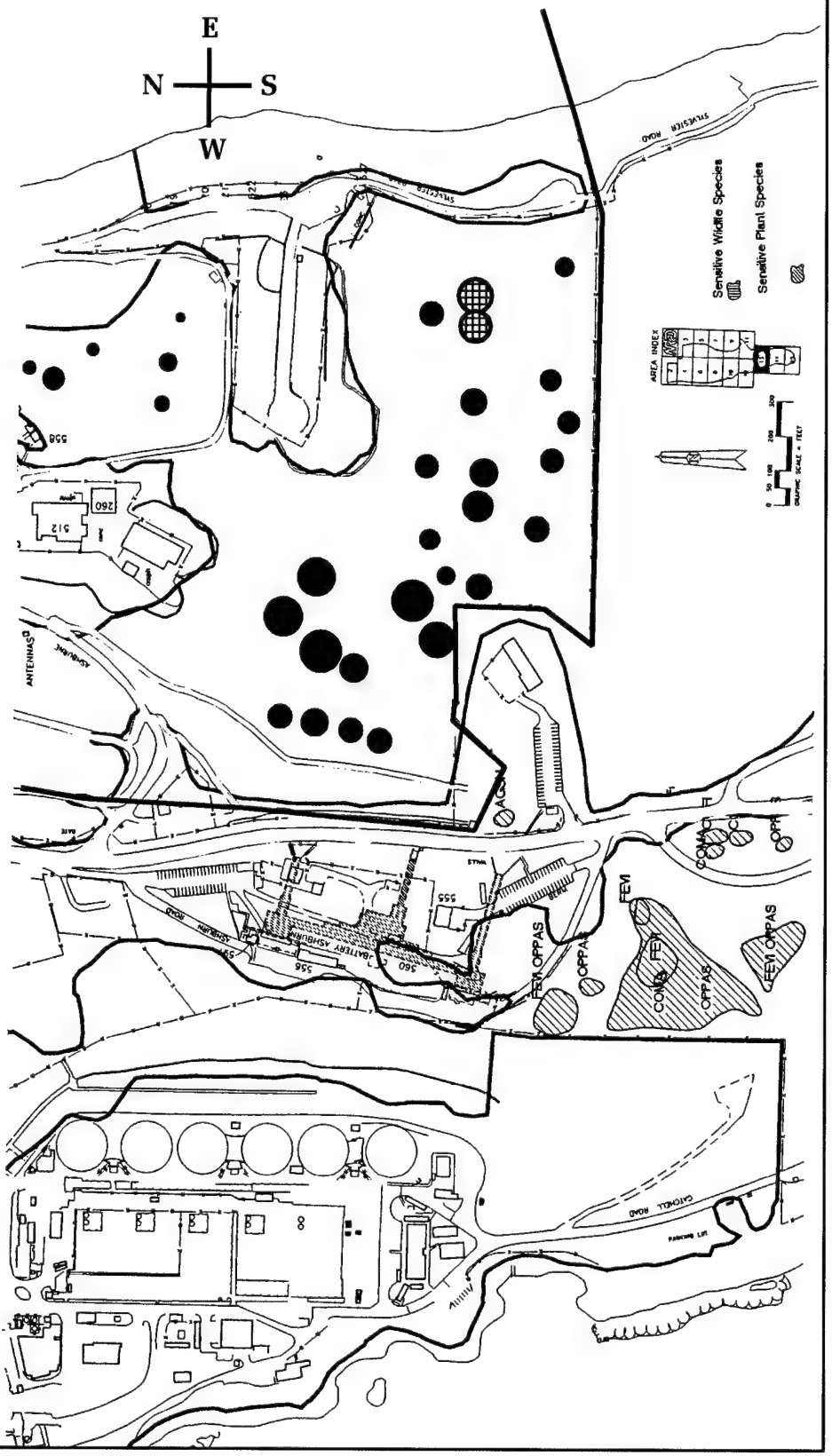
Opuntia parryi var serpentina

Ceanothus verrucosus

Ferocactus viridescens

Rhamnus crocea

Stipa coronata



Appendix B) Bird List

American Crow	*Corvus brachyrhynchos*	
American Kestrel	*Falco sparverius*	
American Robin	*Turdus migratorius*	
Anna's Hummingbird	*Calypte anna*	
Ash-throated Flycatcher	*Myiarchus cinerascens*	
Bank Swallow	*Riparia riparia*	0, CT
Barn Swallow	*Hirundo rustica*	
Beldings Savannah Sparrow	*Passerculus sandwichensis*	C2, CE
Bewick's Wren	*Thyromanes bewickii*	
Black Phoebe	*Sayornis nigricans*	
Black Shouldered Kite	*Accipiter cooperii*	0, CP
Black-crowned Night Heron	*Accipiter striatus*	0, SC3C
Black-headed Grosbeak	*Pheucticus Melanocephalus*	
Black-throated Gr. Warbler	*Dendroica nigrescens*	
Brewer's Blackbird	*Euphagus cyanocephalus*	
Brown Pelican	*Pelecanus occidentalis*	
Brown-headed Cowbird	*Molothrus ater*	
Burrowing Owl	*Athene cunicularia*	0, SC
Bushtit	*Psaltriparus minimus*	
California Black Rail	*Laterallus jamaicensis*	3C, CT
California Brown Pelican	*Pelecanus occidentalis*	FE, CE
California Gnatcatcher	*Polioptila californica*	FT, SC
California Least Tern	*Sterna antillarum browni*	FE, CE
California Quail	*Callipepla californica*	
California Thrasher	*Toxostoma redivivum*	
California Towhee	*Pipilo crissalis*	
Calliope Hummingbird	*Stellula calliope*	
Cassin's Kingbird	*Tyrannus vociferans*	
Cedar Waxwing	*Bombycilla cedrorum*	
Chipping Sparrow	*Spizella passerina*	
Coastal Cactus Wren	*Campylorhynchus brunneicapillus*	C2, 0
Common Flicker	*Colaptes auratus*	

Common Poorwill	*Phalaenoptilus nuttallii*	
Common Raven	*Corvus corax*	
Cooper's Hawk	*Accipiter cooperii*	0, SC
Costa' Hummingbird	*Calypte costae*	
Dark-eyed Junco	*Junco hyemalis*	
Double-crested Cormorant	*Phalacrocorax auritus*	0, CE
European Starling	*Strunus vulgaris*	
Fox Sparrow	*Passerella iliaca*	
Golden Eagle	*Aquila chrysaetos*	0, SC
Golden-crowned Sparrow	*Zonotrichia atricapilla*	
Great Blue Heron	*Ardea herodias*	0, SC
Great Horned Owl	*Bubo virginianus*	
Hammond's Flycatcher	*Empidonax hammondii*	
Hermit Thrush	*Catharus guttatus*	
Hermit Warbler	*Dendroica occidentalis*	
Hooded Oriole	*Icterus cucullatus*	
House Finch	*Carposacus mexicanus*	
Lazuli Bunting	*Passerina amoena*	
Least Bells Vireo	*Vireo bellii pusillus*	FE, CE
Lesser Goldfinch	*Carduelis psaltria*	
Light Footed Clapper Rail	*Rallus longirostris levipes*	FE, CE
MacGillivray's Warbler	*Oporornis tolmiei*	
Mallard	*Anas platyrhynchos*	
Mourning Dove	*Zenaida macroura*	
N. Rough-winged Swallow	*Stelgidopteryx serripennis*	
Nashville Warbler	*Vermivora ruficapilla*	
Northern Harrier	*Circus cyaneus*	0, SC
Northern Mockingbird	*Mimus polyglottos*	
Northern Oriole	*Icterus galbula*	
Olive-sided Flycatcher	*Contopus borealis*	
Orange-crowned Warbler	*Vermivora celata*	
Osprey	*Pandion haliaetus*	0, SC
Pacific-slope Flycatcher	*Empidonax difficilis*	

Peregrine Falcon	*Falco peregrinus*	FE, CE
Pine Siskin	*Carduelis pinus*	
Prairie Falcon	*Falco mexicanus*	0, SC
Red-shouldered Hawk	*Buteo lineatus*	
Red-tailed Hawk	*Buteo jamaicensis*	
Rock Dove	*Columba livia*	
Rufous Hummingbird	*Selasphorus rufus*	
Rufous-crowned Sparrow	*Aimophila ruficeps*	
Rufous-sided Towhee	*Pipilo erythrophthalmus*	
Savannah Sparrow	*Passerculus sandwichensis*	
Say's Phoebe	*Sayornis saya*	
Scrub Jay	*Aphelocoma coerulescens*	
Sharp-shinned Hawk	*Accipiter striatus*	0, SC
Song Sparrow	*Melospiza melodia*	
Southern California	*Aimophila ruficeps canescens*	C2, 0
Surf Scoter	*Melanitta perspicillata*	
Swainson's Thrush	*Catharus ustulatus*	
Townsend's Warbler	*Dendroica townsendi*	
Turkey Vulture	*Cathartes aura*	
Warbling Vireo	*Vireo gilvus*	
Western Gull	*Thyromanes bewickii*	
Western Kingbird	*Tyrannus verticalis*	
Western Meadowlark	*Sturnella neglecta*	
Western Snowy Plover	*Charadrius alexandrinus nivosus*	FT, SC
Western Tanager	*Piranga ludoviciana*	
Western Wood-Pewee	*Contopus sordidulus*	
Western Yellow Billed Cuckoo	*Coccyzus americanus occidentalis*	0, CE
White-crowned Sparrow	*Zonotrichia leucophrys*	
White-throated Swift	*Aeronautes saxatalis*	
Willow Flycatcher	*Empidonax traillii*	0, CE
Wilson's Warbler	*Wilsonia pusilla*	
Wrentit	*Chamaea fasciata*	
Yellow Breasted Chat	*Icteria virens*	0, SC

Yellow Warbler	*Dendroica petechia brewsteri*	0, 0
Yellow-rumped Warbler	*Dendroica coronata*	

Appendix B) Insect List

Common name	Scientific Name	Status
Acmon Blue Butterfly	*Plebejus acmon*	
Alfalfa Looper Moth	*Autographa californica*	
Alfalfa Sulfer Butterfly	*Colias eurytheme*	
American Cockroach	*Periplaneta americana*	
American Sand Wasp	*Bembix americana*	
Andrenid Bee	*Andrena sp.*	
Anise Swallowtail	*Papilio zelicaon*	
Ant	*Camponotus sp.*	
Ant	*Formica sp.*	
Ant	*Irdomyrmex humilis*	
Ant	*Liometopum*	
Ant	*Pogonomyrmex*	
Ant	*Pseudomyrmex apache*	
Ant	*Solenopsis molesta*	
Ant	*Solenopsis xyloni*	
Ant Lions	*Brachynemurus sp.*	
Aphid Wasp	*Aphidius sp.*	
Armyworm Moth	*Pseudaletia unipuncta*	
Ashy Gray Ladybird	*Olla v-nigrum*	
Assassin Bug	*Zelus sp.*	
Bark Beetle	*Scolytidae*	
Bathroom Fly	*Clogmia albipunctata*	
Beach Fly	*Fucellia sp.*	
Bee Assassin	*Apiomerus crassipes*	
Bee Fly	*Bombylius sp.*	
Bee Fly	*Conophorus sp*	
Bee Fly	*Heterostylum sp.*	
Bee Fly	*Villa sp.*	
Beet Armyworm Moth	*Spodoptera exigua*	
Bernardino Blue Butterfly	*Euphilotes battoides bernardino*	
Big Black Horse Fly	*Tabanus punctifer*	

Big Red Skimmer	*Libellula saturata*	
Big-headed Bugs	*Geocoris sp.*	
Bird Lice		
Black Cutworm Moth	*Agrotis iosilon*	
Blow Fly	*Cochliomyia*	
Blue Bottle Fly	*Calliphora sp.*	
Blue Mud Wasp	*Chalybion*	
Bordered Plant Bug	*Largus cinctus*	
Braconid Wasp	*Braconidae*	
Bramble Hairstreak	*Callophyrs dumetorum*	
Bristletails:	*Machilinus sp.*	
Brown Lacewings	*Hemerobius sp.*	
Brown Lacewings	*Micromus sp.*	
Buckeye Butterfly	*Precis coenia*	
Bumble Bee Conopid	*Physocephala texana*	
Bumblebee Robber Fly	*Mallophora fautrix*	
Burrower Bugs	*Pangaeus sp.*	
Cabbage Looper Moth	*Trichoplusia ni*	
Cactus Fly	*Copestylum mexicana*	
California Bumble Bee	*Bombus californicus*	
California Ladybird	*Coccinella californica*	
California Mantis:	*Stagmomantis*	
California Red Scale	*Aonidiella aurantii*	
California Velvet Ant	*Dasymutilla*	
Carpet Beetle	*Anthrenus sp.*	
Checkered White	*Pieris protodice*	
Chloropid Fly	*Chloropidae*	
Chocolate Looper Moth	*Autographa biloba*	
Click Beetles	*Conoderus exsul*	
Common Crane Fly	*Tipula planicornis*	
Common Green Darner	*Aeshna multicolor*	
Common Hairstreak	*Strymon melinus*	
Convergent Ladybird	*Hippodamia*	

Corn Earworm Moth	*Helicoverpa zea*	
Cottony-cushion	*Icerya purchasi*	
Cuckoo Wasp	*Chrysididae*	
Dainty Dwarf Butterfly	*Nathalis iole*	
Dancer	*Argia sp.*	
Dancer	*Enallagma sp.*	
Dancer	*Ischnura sp.*	
Darkling Beetle	*Cratidus osculans*	
Darkling Beetle	*Eleodes nigropilosis*	
Darkling Beetle	*Eleodes omissus*	
Darkling Beetle	*Eleodes sp.*	
Darkling Beetle	*Helops confluens*	
Digger Bee	*Anthophora sp.*	
Digger Bee	*Diadasia sp.*	
Digger Bee	*Melissodes sp.*	
Drone Fly	*Eristalis tenax*	
Earwig	*Labiduridae riparia*	
Edward's Bumble Bee	*Bombus edwardsii*	
Electra Buckmoth	*Hemileuca electra*	
Encyrtid Wasp	*Encyrtidae*	
Eucalyptus Longhorn	*Phoracantha*	
Eufala Skipper Butterfly	*Hylephila phyleus*	
Eulophid Wasp	*Eulophidae*	
European Cabbage White	*Pieris rapae*	
European Earwig	*Forficula auricularia*	
European House Cricket	*Acheta domesticus*	
European Mantis:	*Iris oratoria*	
False Chinch Bug	*Nyssius raphanus*	
Field Crickets	*Gryllus sp.*	
Field Roach	*Blattella vaga*	
Field Skipper Butterfly	*Apatelodes campestris*	
Fiery Skipper Butterfly	*Heliopetes ericetorum*	
Flat Planthoppers	*Flatidae*	

Fleas	*Siphonaptera*	
Flesh Fly	*Sarcophagidae*	
Fork-tailed Bush Katydid	*Scudderia mexicana*	
Froghoppers	*Cercopidae*	
Fruit Fly	*Trupanea sp.*	
Fuller's Rose Weevil	Asynonychus	
Funeral Duskywing	*Erynnis funeralis*	
Gall Wasp	*Cynipidae*	
Gelechiid Moth	*Gelechiidae*	
Genista Moth	*Uresiphita reversalis*	
German Cockroach	*Blattella germanica*	
Giant Swallowtail	*Papilio cresphontes*	
Golden Paper Wasp	*Polistes fuscatus*	
Granulate Cutworm Moth	*Agrotis subterranea*	
Grasshopper	*Melaoplus sp.*	
Grasshopper	*Trimarotropis sp.*	
Gray bird grasshopper	*Schistocerca nitens*	
Green Bottle Fly	*Phaenicia sericata*	
Green June Beetle	Continus mutibilis	
Green Lacewings	*Chrysoperla sp.*	
Ground Beetle	*Calosoma semilaeve*	
Ground Beetle	*Calathus ruficollis*	
Ground Beetle	*Tanystoma maculicolle*	
Gulf Fritillary Butterfly	*Agraulis vanillae*	
Halicitid Bee	*Dialictus sp.*	
Halicitid Bee	*Duforea sp.*	
Halicitid Bee	*Halictus sp.*	
Halicitid Bee	*Lasioglossum sp.*	
Harlequin Bug	*Murgantia histrionica*	
Harlequin Bug	*Thyanta sp.*	
Honey Bee	*Apis melifera*	
House Fly	*Musca domestica*	
Humpbacked Fly	*Phoridae*	

Ichneumonid Wasp	*Paracentrobia sp.*	
Ichneumonid Wasp	*Trichogramma sp.*	
Indian Meal Moth	*Plodia interpunctella*	
Ironclad Beetle	*Phloeodes pustulosus*	
Jumping Plant Lice	*Psyllidae*	
Lace Bugs	*Tingidae*	
Ladybird Beetle	*Cycloneda munda*	
Large Blue Mud Dauber	*Chlorion aerarium*	
Large White Skipper	*Heliopetes ericetorum*	
Leaf Beetle	*Altica foliacea*	
Leaf Beetle	*Coscinoptera sp.*	
Leaf Beetle	*Diabrotica balteata*	
Leaf Beetle	*Diachus auratus*	
Leaf Beetle	*Lema trilineata*	
Leaf Beetle	*Microrhopala*	
Leaf Beetle	*Saxinus saucia*	
Leaf Beetle	*Trihabda sp.*	
Leaf-legged Bugs	*Leptoglossus sp.*	
Leaf-miner Fly	*Agromyzidae*	
Leafcutting Bee	*Anthidium sp.*	
Leafcutting Bee	*Chalicodoma sp.*	
Leafcutting Bee	*Megachile sp.*	
Leafcutting Bee	*Osmia sp.*	
Long-legged Fly	*Dolichopodidae*	
Longhorn Beetle	*Ipochus fasciculatus*	
Longhorn Beetle	*Lepturinae sp.*	
MacDunnough's Pero	*Pero macdunnoughi*	
March Fly	*Bibionidae*	
Marine Blue Butterfly	*Leptotes marina*	
May Beetles	*Cyclocephala sp.*	
Mayflies:	*Family Baetidae*	
Meal Moth	*Pyrausta depalis*	
Mealybugs	*pseudococcus sp.*	

Measuring Worm Moth	*Camptogramma*	
Measuring Worm Moth	*Drepanulatrix sp.*	
Measuring Worm Moth	*Euphyia implicata*	
Measuring Worm Moth	*Eupithecia sp.*	
Measuring Worm Moth	*Itame sp.*	
Measuring Worm Moth	*Platea californica*	
Measuring Worm Moth	*Semiothias sp.*	
Measuring Worm Moth	*Stamnodes sp.*	
Medusa Moth	*Gloveria medusa*	
Metallic Sweat Bee	*Agapostemon sp.*	
Mexican Tiger Moth	*Apantesis proxima*	
Milkweed Bug	*Lygaeus kalmii*	
Minute Pirate Bugs	*Anthocoridae*	
Monarch Butterfly	*Danaus plexippus*	
Moon Umber Moth	*Zale lunata*	
Mormon Metalmark	*Apodemia mormo*	
Mornful Duskywing	*Erynnis funeralis*	
Mosquito	*Culicidae*	
Mourning-Cloak Butterfly	*Nymphalis antiopa*	
Mud Dauber Wasp	*Sceliphron*	
Multicolored Darner	*Anax junius*	
Mydas Fly	*Pseudonomoneura*	
Navel Orange Worm	*Amyelois transitella*	
Negro Bugs	*Corimelaena sp.*	
Nicippe Yellow Butterfly	*Eurema nicippe*	
Omnivorous Looper Moth	*Sabulodes aegrotata*	
Oriental Cockroach	*Blatta orientalis*	
Owlet Moth	*Apamea cinefacta*	
Owlet Moth	*Euacontia semirufa*	
Owlet Moth	*Heliothis virescens*	
Owlet Moth	*Hemeroplanis finitima*	
Owlet Moth	*Orthodes sp.*	
Painted Arachinis	*Arachnis picta*	

Painted Lady Butterfly	*Vanessa cardui*	
Paper Wasp	*Ancistrocerus sp.*	
Pastel Skimmer	*Sympetrum coruptum*	
Picture-winged Fly	*Pogonartalis doclea*	
Plant Bugs:	*Lygus sp.*	
Plant Bugs:	*Rhinacloa sp.*	
Plasterer Bee	*Colletes sp.*	
Platygasterid Wasp	*Platygasteridae*	
Plume Moth	*Pterophoridae*	
Pomace Fly	*Drosophila sp.*	
Powder-Post Beetle	*Lyctidae*	
Psocids and Lice:	*Liposcelididae sp.*	
Pteromalid Wasp	*Pteromalidae*	
Pygmy Blue Butterfly	*Brephidium exilis*	
Pyralid Moth	*Jocara trabalis*	
Pyralid Moth	*Pyrausta depalis*	
Red Admiral Butterfly	*Vanessa atalanta*	
Ring-legged Earwig	*Euborellia annulipes*	
Robber Fly	*Cophura vanduzeei*	
Robber Fly	*Procantacanthus*	
Rose Aphid	*Microsiphum rosae*	
Rove Beetles	*Cafius sp.*	
Sand Wasp	*Bembix comata*	
Sandhill Skipper	*Polites sabuleti*	
Sawfly	*Tenthredinidae*	
Say's Stink Bug	*Chlorochroa sayi*	
Scarab Beetle	*Diplotaxis sp.*	
Scarab Beetle	*Serica sp.*	
Scelionid Wasp	*Scelionidae*	
Scentless Plant Bugs	*Arhyssus sp.*	
Seaweed Fly	*Coelopa sp.*	
Seed Beetle	*Acanthoscelides*	
Senna Sulfer Butterfly	*Phoebis sennae*	

Shore Fly	*Ephydridae*	
Silverfish:	*Lepisma saccharia*	
Skimmer	*Libellula croceipennis*	
Skimmer	*Pachydiplax*	
Skimmer	*Tramea lascerata*	
Smoke Tree Leafhopper	*Homalodisca lacerta*	
Soft Scales	*Coccidae*	
Soft-winged Flower	*Melyridae*	
Soldier Beetle	Cantharidae	
Sonoran Bumble Bee	*Bombus sonorus*	
Southern Blue Butterfly	*Glaucopsyche lygdamus australis*	
Sphecid Wasp	*Podalonia argentifrons*	
Sphecid Wasp	*Podalonia sp.*	
Sphecid Wasp	*Prionyx sp.*	
Sphecid Wasp	*Psammaecius sp.*	
Sphecid Wasp	*Sphex ichneumoneus*	
Sphecid Wasp	*Tachysphex sp.*	
Spider Wasp	*Anoplius sp.*	
Spider Wasp	Aporinellus sp.	
Spider Wasp	*Aporus sp.*	
Spider Wasp	*Pepsis sp.*	
Spittlebugs	*Aphrophora sp.*	
Spotted Cucumber Beetle	*Diabrotica*	
Springtails:	*Isotoma sp.*	
Squash Bug	*Anasa tristis*	
Stable Fly	*Stomoxys calcitrans*	
Stink Bugs:	*Brochymena sp.*	
Tachinid Fly	*Archytas apicifer*	
Termites	*Amitermes wheeleri*	
Thread-waisted Wasps	*Ammophila sp.*	
Thrips:		
Tiger Swallowtail	*Papilio rutulus*	
Tiphiid Wasp	*Brachycistis sp.*	

Tobacco Hornworm	*Manduca sexta*	
Tortricid Moth	*Amorbia cuneana*	
Tree Crickets	*Oecanthus sp.*	
Treehoppers	*Membracidae*	
Tumbling Flower Beetle	*Mordella sp.*	
Twig Borers	*Bostrichidae*	
Two-stabbed Ladybird	*Chilocorus orbus*	
Umber Skipper Butterfly	*Paratrytone melane*	
Valley Carpenter Bee	*Xylocopa varipuncta*	
Van Duzee's Cicada	*Okanogana vanduzeei*	
Variegated Cutworm	*Peridroma saucia*	
Vegetable Weevil	*Listroderes sp.*	
Velvet Ant	*Chyphotes sp.*	
Velvet Ant	*Sphaeropthalma sp.*	
Vinegar Fly	*Drosophila*	
Virginia Lady Butterfly	*Vanessa virginiensis*	
Vosnesenski's Bumble	*Bombus vonesenskii*	
Wandering Skipper	*Panoquina errans*	C2
Water Midge	*Chironomidae*	
Webspinners:	*Oligotomidae sp.*	
West Coast Lady	*Vanessa annabella*	
Western Checkered	*Pyrgus albescens*	
Western Drywood	*Incistermes minor*	
Western Elfin Butterfly	*Incisalia augustinus*	
Western Flower Thrips	*Frankliniella*	
Western Paper Wasp	*Polistes dorsalis*	
Western Subterranean	*Reticulitermes*	
Western Tailed Blue	*Everes amyntula*	
Western Tussock Moth	*Orgyia cana*	
White-lined Sphinx	*Hyles lineata*	
Whiteflies	*Aleyrodidae*	
Window Fly	*Hermetia illucens*	
Woodland Skipper	*Ochlodes sylvanoides*	

Yellow-faced Bee	*Hylaeus sp.*	
Yellow-Striped	*Spodoptera*	
Yellowjacket	*Vespula pensylvanica*	

Appendix B) Plant List: Sensitive Plants

Common Name	Scientific Name	Status
Wart-stemmed Ceanothus	*Ceanothus verrucosus*	C2,0
Chaparral Mallow	*Malachothamnus fasciculatus*	C1,CE
Nuttall's Scrub Oak	*Quercus dumosa*	C2,0
Coast Barrel Cactus	*Ferocactus viridescens*	C2,0
Cane Cholla, Snake Cholla	*Opuntia parryi var serpentina*	C2,0

Appendix B) Plant List

General Category	Common Name	Scientific Name
Perennial shrub	Chamise	*Adenostoma fasciculatum*
Perennial shrub	California Sagebrush	*Artemisia californica*
Perennial herb	Locoweed	*Astragalus trichopodus spp. leucopsis*
Perennial misplaced	Coyote Bush	*Baccharis pilularis var. consanguinea*
Perennial shrub	Broom Baccharis	*Baccharis sarothroides*
Perennial shrub	Wart-stemmed Ceanothus	*Ceanothus verrucosus*
Perennial shrub	Bush Sunflower	*Encelia californica*
Perennial shrub	Bushrue	*Cneoridium dumosum*
Perennial shrub	Yerba Santa	*Eriodictyon crassifolium*
Annual	Flat-Topped Buckwheat	*Eriogonum deflexum*
Perennial shrub	Cliff Spurge	*Euphorbia misera*
Perennial shrub	Common Hazardia	*Hazardia squarrosa var. grindelioides*
Perennial shrub	Goldenbush	*Isocoma ...? was Haplopappus venetus*
Perennial shrub	Christmas Berry, Toyon	*Heteromeles arbutifolia*
Perennial shrub	Bladderpod	*Isomeris arborea*
Perennial herb	California Broom	*Lotus scoparius var.?*
Perennial shrub	Chaparral Mallow	*Malachothamnus fasciculatus*
Perennial shrub	Laurel Sumac	*Malosoma laurina*
Perennial shrub	Wishbone Bush	*Mirabilis Californica*
Perennial shrub	Nuttall's Scrub Oak	*Quercus dumosa*
Perennial shrub	Spiny Redberry	*Rhamnus crocea*
Perennial shrub	Lemonade Berry	*Rhus integrifolia*
Perennial shrub	Black Sage	*Salvia mellifera*
Perennial herb	White Nightshade	*Solanum douglasii*
Perennial herb	Purple Nightshade	*Solanum xanti*
Perennial shrub	Mission Manzanita	*Xylococcus bicolor*
Perennial herb	Western Ragweed	*Ambrosia psilostachya*
Annual	Nuttles Snapdragon	*Antirrhinum nuttallianum*
Annual	Wild Celery	*Apiastrum angustifolium*
Annual	California Sun Cup	*Camissonia bistorta*

Annual	Sun Cups	*Camissonia robusta*
Annual	Canchalagua	*Centaurium venustum*
Annual	Yellow Pincushion	*Chaenactis glabriuscula var. orcuttiana*
Annual	Fringed Spineflower	*Chorizanthe fimbriata var fimbriata*
Annual	California Spineflower	*Mucronea californica*
Annual	Miner's Lettuce	*Claytonia perfoliata ssp. ?*
Annual	Popcorn Flower	*Cryptantha intermedia*
Annual	Eucrypta	*Eucrypta chrysanthemifolia var.*
Annual	Goose Grass	*Galium aparine*
Annual	Cudweed	*Gnaphalium californicum*
Annual	Cudweed	*Gnaphalium stramineum*
Annual	Tarweed	*Hemizonia fasciculata*
Annual	Telegraph Weed	*Heterotheca grandiflora*
Annual	Western Nettle	*Hesperocnide tenella*
Annual	Toad Rush	*Juncus bufonius var ?*
Annual	Lupine	*Lupinus truncatus*
Perennial herb	Wild Cucumber	*Marah macrocarpus*
Annual	Skunkweed	*Navarretia hamata ssp. hamata*
Annual	Narrowleaf Oligomeris	*Oligomeris linifolia*
Perennial herb	California Penstemon	*Penstemon californicus*
Annual	Common Phacelia	*Phacelia distans*
Annual	Twiggy Wreath Plant	*Stephanomeria virgata*
Annual	Everlasting Nest Straw	*Stylocline gnaphaloides*
Annual	Beach-Bur	*Ambrosia chamissonis*
Perennial bulb	Mariposa Lily (lavender)	*Calochortus splendens*
Perennial bulb	Mariposa Lily (yellow,	*Calochortus weedii var. weedii*
Perennial herb	Morning Glory	*Calystegia macrostegia*
Annual	Milk Maids, Tooth Wort	*Cardamine californica*
Perennial herb	Beach Sand Mat	*Cardionema ramosissimum*
Perennial herb	Wooly Indian Paintbrush	*Castilleja foliolosa*
Perennial	Ropevine	*Clematis pauciflora*
Annual	Bird's Beak	*Cordylanthus rigidus setigerus*

Perennial herb	Sea-Dahlia	*Coreopsis maritima*
Perennial herb	California-Aster	*Lessingia filaginifolia var. filaginifolia*
Annual	Popcorn Flower	*Cryptantha*
Annual	Dodder	*Cuscutaceae californica var. californica*
Annual	Purple or Red Bush	*Mimulus punceus*
Perennial herb	Shooting Star	*Dodecatheon clevelandii ssp.*
Annual	Wooly Sunflower	*Eriophyllum confertiflorum*
Perennial herb	Rattlesnake Weed	*Euphorbiaceae albomarginata*
Perennial herb	Climbing Bedstraw	*Galium porrigens var. porrigens*
Perennial	Cudweed, Everlasting	*Gnaphalium bicolor*
Perrennial herb	Common Rock Rose	*Helianthemum scoparium (no variety*
Perennial herb	Heliotrope	*Heliotropium curassavicum (no variey*
Perennial herb	Shiny Lomatium	*Lomatium lucidum*
Perennial	Coffee Fern	*Pellaea andromedaefolia*
Perennial herb	Sand Plant	*Pholisma arenarium*
Perennial	Goldback or Silverback Fern	*Pentagramma triangularis ssp. viscosa*
Perennial	California Polypody	*Polypodium californicum*
Annual	Catchfly, Campion	*Silene laciniata ssp. major*
Perennial	SD Co. Sunflower	*Viguiera laciniata*
Perennial grass	Bent Grass	*Agrostis pallens*
Annual grass	Six-Weeks Three-Awn	*Aristida adscensionis*
Perennial grass	Cane Bluestem	*Bothriochloa barbinodis*
Perennial grass	Saltgrass	*Distichlis spicata*
Annual grass	Littleseed Muhly	*Muhlenbergia microsperma*
Perennial grass	Needlegrass	*Achnatherum parishii*
Perennial herb	Foothill Needlegrass	*Nassella lepida*
Perennial grass	Blue Wildrye	*Elymus glaucus*
Perennial bulb	Star Lily	*Zigadenus fremontii*
Perennial bulb	Wild Onion, Garlic	*Allium praecox*
Perennial bulb	Ookow	*Dichelostemma congestum*
Perennial bulb	Soap Plant, Amole	*Chlorogalum parviflorum*
Perennial cacti	Golden-Spined Cereus	*Bergerocactus emoryi*

Perennial	Lady Fingers	*Dudleya edulis*
Perennial	Lance-leaved Dudleya	*Dudleya lancelolata*
Perennial	Chalk Live-forever	*Dudleya pulverulenta*
Perennial cacti	Coast Barrel Cactus	*Ferocactus viridescens*
Perennial cacti	Prickly-Pear, Cholla	*Opuntia littoralis*
Perennial cacti	Snake Cholla	*Opuntia parryi var serpentina*
Perennial cacti	Coastal Cholla	*Opuntia prolifera*
Perennial	Mohave Yucca	*Yucca schidigera*
Perennial misplaced	Beach Evening Primrose	*Camissonia cheiranthifolia*
Perennial	Desert Indian Paintbrush	*Castilleja angustifolia*
Perennial misplaced	California Buckwheat	*Eriogonum fasciculatum ssp. foliolosum*
Annual	Alkali Lotus	*Lotus salsuginosus var. salsuginosus*
Annual misplaced nat.	Arroyo Lupine	*Lupinus succulentus*
Annual	California Poppy	*Eschscholzia California*
Perennial misplaced	Brittlebush, Incienso	*Encelia Farinosa*
Perennial misplaced	Beardtongue	*Penstemon spectabilis*
Perennial weed	Acacia	*Acacia longifolia*
Perennial weed	Prostrate Acacia	*Acacia sp.*
Perennial weed	Acacia	*Acacia latifolia*
Perennial misplaced	Sagebrush	*Artemisia tridentata*
Perennial herb	Five Hook Bassia	*Bassia hyssopifolia*
Perennial weed	Binweed, Orchard	*Convolvulus arvensis*
Perennial weed	Hottentot fig	*Carpo brotus*
Perennial weed	Nutsedge, Galingale	*Cyperus eculentus*
Perennial misplaced	Wild Buckwheat	*Eriogonum giganteum*
Perennial weed	Fennel	*Foeniculum vulgare*
Perennial weed	Tree Tobacco	*Nicotiana glauca*
Perennial weed	Castor Bean	*Ricinus communis*
Perennial weed	Curly Dock	*Rumex crispus*
Biennal weed	Salsify, Oyster Plant	*Tragopogon porrifolius*
Annual weed	Poor-Man's Weatherglass,	*Anagallis arvensis*
Perennial weed	Australian Saltbush	*Atriplex semibaccata*

Annual weed	Black Mustard	*Brassica nigra*
Annual weed	Yellow Star-Thistle	*Centaurea solstitialis*
Annual weed	Pigweed, Lamb's Quarters	*Chenopodium album*
Annual weed	Spotted Spurge	*Chamaesyce maculata*
Annual weed	Horseweed	*Conyza canadensis*
Annual weed	Storksbill, Filaree	*Erodium botrys*
Annual weed	Storksbill, Filaree	*Erodium cicutarium*
Annual weed	Whitestem Filaree	*Erodium moschatum*
Annual weed	Cudweed, Everlasting	*Gnaphalium luteo-album*
Annual weed	Prickly Lettuce	*Lactuca serriola*
Annual weed	Cheeseweed, Little Mallow	*Malva parviflora*
Annual weed	White Sweetclover	*Melilotus alba*
Annual weed	Sourclover	*Melilotus indica*
Annual weed	Crystalline Iceplant	*Mesembryanthemum crystallinum*
Perennial weed	Slender-Leaved Iceplant	*Mesembryanthemum nodiflorum*
Perennial weed	Bermuda Buttercup	*Oxalis pes-caprae*
Annual weed	Common Knotweed,	*Polygonum arenastrum*
Annual weed	Wild Radish	*Raphanus sativus*
Annual weed	Russian Thistle,	*Salsola tragus*
Annual weed	Catchfly, Campion	*Silene gallica*
Perennial weed	Dandelion	*Taraxacum officinale*
Annual weed	Slender Wild Oat	*Avena barbata*
Annual weed	Ripcut Grass	*Bromus grandis*
Annual weed	Soft Chess	*Bromus hordeaceus*
Perennial weed	Pampas Grass	*Cortaderia selloana*
Perennial weed	Bermud Grass	*Cynodon dactylon*
Annual weed	Nit Grass	*Gastridium ventricosum*
Annual weed	Italian Ryegrass	*Lolium multiflorum*
Perennial weed	Smilo Grass	*Piptatherum miliaceum*
Annual weed	Annual Beard Grass	
Perennial weed	Smutgrass	*Sporobolus indicus*

Appendix B) Reptile List

Amphibians and Reptiles **Common Name**	***Scientific Name***	**Status**
Pacific slender salamander	*Batrachoseps pacificus major*	
Coronado skink	*Eumeces skiltonianus interparietalis*	C2,SC
Orange-throated whiptail	*Cnemidophorus Hyperythrus*	C2, SC
San Diego alligator lizard	*Gerrhonotus multicarinatus webbi*	
Western fence lizard	*Sceloporus occidentalis*	
Side-blotched lizard	*Uta stansburiana*	
California kingsnake	*Lampropeltis getulus californiae*	
Chaparral whipsnake (striped	*Masticophis lateralis lateralis*	
Southern Pacific rattlesnake	*Ctotalus viridis helleri*	
San Diego ringneck snake	*Diadophis punctatus similis*	C2,--
San Diego gopher snake	*Pituophis melanoleucus annectens*	
Not seen on SUBASE		
Coastal western whiptail	*Cnemidophorus tigris multiscutatus*	C2,--
San Diego horned lizard	*Phrynosoma coronatum blainvillei*	C2, SC
No. red diamond rattlesmake	*Crotalus ruber ruber*	C2, SC
Coastal rosy boa	*Lichanura trivirgata rosafusca*	C2,--
Coast patch-nosed snake	*Salvadora hexalepis virgultea*	C2, SC

Appendix C- Point Loma Bat Survey, 1994

January 9, 1995

To: Dr.Jerry Boggs
Southwest Division
Naval Facilities Engineering Command
1220 Pacific Highway, Code 231 JB
San Diego, CA 93132-5190

From: Dr. Patricia Brown-Berry
134 Wilkes Crest
Bishop, CA 93514

Regarding: Semi-annual report for period ending 31 December, 1995 for bat survey of Navy facilities at Pt. Loma.

Field work was conducted at Point Loma from August 17 through 22, 1994. With the exception of the evening of August 21, nightly surveys were conducted by setting mist nets at the Transdec pool and driving around Point Loma stopping to listen for both audible and ultrasonic bat signals. Throughout this period loud, continuous ultrasounds in the 40-55 kHz range were detected at locations throughout the base, with the greatest intensity being towards Bayside. The sounds could originate from radar installations on Pt. Loma or North Island. These could be effective sonic deterrents for bats. In addition, very few insects were seen flying beneath lights at night. This could account for the fact that no bats were captured, detected or seen during this survey period, with the exception of overflights by western mastiff bats (*Eumops perotis*) on 20 and 22 August, with the earliest pass heard two hours after dark. In November, an injured *Eumops* found near the coast guard facility was turned into animal rehabilitation personnel.

cc. Mary Platter-Reiger
Chris Grunewald

January 11, 1995

To: Dr. Jerry Boggs
Southwest Division
Naval Facilities Engineering Command
1220 Pacific Highway, Code 231 JB
San Diego, CA 93132-5190

From: Dr. Patricia Brown-Berry
134 Wilkes Crest
Bishop, CA 93514

Regarding: Bat Surveys on Point Loma Peninsula

The 1994 bat surveys at Point Loma have been disappointing, with only one species detected to date. This past year was also a low rainfall year, and very few nocturnal flying insects were observed. With the abundant rainfall this winter season, I am requesting a no-cost, time extension on the attached contract administered through U.C.L.A.. In order to survey during the spring/summer period, I would the project period extended through September 30, 1995, with the draft final report due November 30, 1995.

cc. Mary Platter-Reiger
Chris Grunewald
Dan Horowitz, U.C.L.A.

February 24, 1994

To: Dr.Jerry Boggs
Southwest Division
Naval Facilities Engineering Command
1220 Pacific Highway, Code 231 JB
San Diego, CA 93132-5190

From: Dr. Patricia Brown-Berry
658 Sonja Court
Ridgecrest, CA 93555

Regarding: Quarterly report for period ending 31 December 1993 for bat survey of Navy facilities at Pt. Loma.

Following the planning meeting at Southwest Div on October 26, 1993, we were unable to get access to Pt. Loma. Met Mary Platter-Reiger (Nrad) on October 27 and secured passes for Nrad and Sub-base. At 2150 heard the distinctive audible echolocation signal of a western mastiff bat (*Eumops perotis*) as it foraged over "Bryce Canyon". At 2230 hours, another *Eumops* flew by "Valley of the Drums".

cc. Mary Platter-Reiger
Pt. Loma

May 4, 1994

To: Dr.Jerry Boggs
Southwest Division
Naval Facilities Engineering Command
1220 Pacific Highway, Code 231 JB
San Diego, CA 93132-5190

From: Dr. Patricia Brown-Berry
658 Sonja Court
Ridgecrest, CA 93555

Regarding: Quarterly Report for period ending 31 March 1994 for Bat Survey of Navy facilities at Pt. Loma.

An early spring survey was conducted March 3-5, 1994 that was timed to coincide with potential bat migration along the coastal corridor. Various sites on NRad and Subbase were checked after dark for the presence of bats utilizing ultrasonic detectors and night vision equipment. No bats were seen or heard. A pervasive steady 48-50 kHz sound was detected on most areas of the peninsula. This could be acting as a sonic deterrent for bats. Howard Overton at the Cabrillo National Monument was interviewed and reported seeing a few bats flying around the parking lot over the past 14 years during the summer months. Inspections were made of facilities that might shelter bats. The EOD wooden building had a few pieces of old bat guano (*Myotis*) near the second floor window. No other bat sign was observed.

The summer survey period will hopefully occur in mid-summer when nights are calm, clear and warm. An effort will be made to contact personnel involved in building maintenance who might have noticed bats or bat sign. Permission needs to be obtained for access to Transdec after dark. If there is a period when the 48 kHz signal is not being emitted, that would increase the probability of detecting bats.

cc. Mary Platter-Reiger, NRad
CDR Sam Smith, Subbase

June 6, 1995

To: Dr.Jerry Boggs
Southwest Division
Naval Facilities Engineering Command
1220 Pacific Highway, Code 231 JB
San Diego, CA 93132-5190

From: Dr. Patricia Brown-Berry
134 Wilkes Crest
Bishop, CA 93514

Regarding: Semi-annual report for period ending 6 June, 1995 for bat survey of Navy facilities at Pt. Loma.

Field work was conducted at Point Loma from July 3-6, 1995. On the evening of July 3, a mist net was set at the Transdec pool and an Anabat used to remotely monitor bat echolocation signals there and at Cabrillo Monument. On July 4 monitoring was again conducted at several locations on Topside, while on July 5 the detectors were employed at Bayside. On July 4 a medium-sized bat (possibly *Eptesicus*) was seen flying near Cabrillo Monument. No bat signals were detected with the exception of audible pulses of the western mastiff bats (*Eumops perotis*) which were heard on July 3 and 4, with the earliest pass heard two hours after dark. A visit was made to the Coast Guard Facility near the current lighthouse since in November 1994 an injured *Eumops* was found near here ,but none of the coast guard personnel now there had knowledge of this record.

cc. Mary Platter-Reiger
Chris Grunewald

July 14, 1994

To: Dr.Jerry Boggs
Southwest Division
Naval Facilities Engineering Command
1220 Pacific Highway, Code 231 JB
San Diego, CA 93132-5190

From: Dr. Patricia Brown-Berry
658 Sonja Court
Ridgecrest, CA 93555

Regarding: Quarterly report for period ending 30 June, 1994 for bat survey of Navy facilities at Pt. Loma.

No field work was conducted at Point Loma during this period. The next survey work will be conducted during August.

cc. Mary Platter-Reiger
Chris Grunewald

January 22, 1996

To: Dr.Jerry Boggs
Southwest Division
Naval Facilities Engineering Command
1220 Pacific Highway, Code 231 JB
San Diego, CA 93132-5190

From: Dr. Patricia Brown-Berry
134 Wilkes Crest
Bishop, CA 93514

Regarding: Semi-annual report for period ending 31 December, 1996 for bat survey of Navy facilities at Pt. Loma.

Field work was conducted at Point Loma from October 12-13, 1995. On the evening of October 12, Anabat detectors with delay switches and tape recorders were used to remotely monitor the bat signals from dusk until dawn at the cemetery and Steam Plant Road beneath the cliffs. One Mexican free-tailed bat (*Tadarida brasiliensis*) passed by the cliffs at 2:15 AM. Since western mastiff bat (*Eumops perotis*) emit signals too low in frequency to be detected by the Anabat, but audible to most humans, we conducted audible surveys between 1930-2300 hours at several locations on Topside. Two *Eumops* passed over the cemetery at 2240, but otherwise, no bats were heard.

cc. Mary Platter-Reiger
Dan Horowitz, U.C.L.A Biology Dept.

Appendix D- SUBASE Non-native Plant Maps, 1995

MAP APPENDIXES

APPENDIX A : Topographical maps of exotic pest plant species: NRaD map area index numbers 5, 7, 11 and 13; pages 1, 2, 3, 4 and 5 respectively.

APPENDIX B : Sensitive Species area maps with exotic pest plant species: NRaD map area numbers 5, 7, 11 and 13; pages 1, 2, 3, 4 and 5 respectively.

APPENDIXES A & B LEGEND (exotic pest plant species)

= Dark brown line indicates limit of plant survey.

= Carpobrotus, iceplant: Light green indicates coverage composed of iceplant species; 95+% Carpobrotus edulis, the hottentot-fig, freeway, or African iceplant from S. Africa.

= Acacia, wattle: Orange indicates canopy of Acacia sp.; Most appear to be Acacia longifolia, the golden, or freeway wattle from Australia.

= Eucalyptus, gum tree: Pink indicates canopy of gum tree; E. globulus, blue gum, E. camaldulensis, red gum, E. cladocalyx, sugar gum and E. sideroxylon, red iron bark, from Australia.

= Foeniculum, wild fennel: Purple indicates plants of F. vulgare, fennel or anise from s Europe.

= Nicotiana, tree tobacco: Dark green dots with a black slash indicates a plant of N. glauca from S. America.

= Arundo, giant reed: Light brown indicates coverage of A. donax, from the Mediterranean.

= Cortaderia, jubata or pampas grass: Red dots indicate clumps of C. jubata and perhaps some C. sellaoana (pampas) from e S. America.

= Ricinus, castor bean: Light blue indicates plants of R. communis, from Europe.

= Myporum, myporum: Dark blue dots indicate plants of M. laetum from New Zealand.

= Caesalpina, tara: Orange-yellow with X's indicate areas having C. spinosa from S. America.

= Centaurea, tocalote: Black and gray stippled areas indicate areas with C. metilensis, a star-thistle from s Europe.

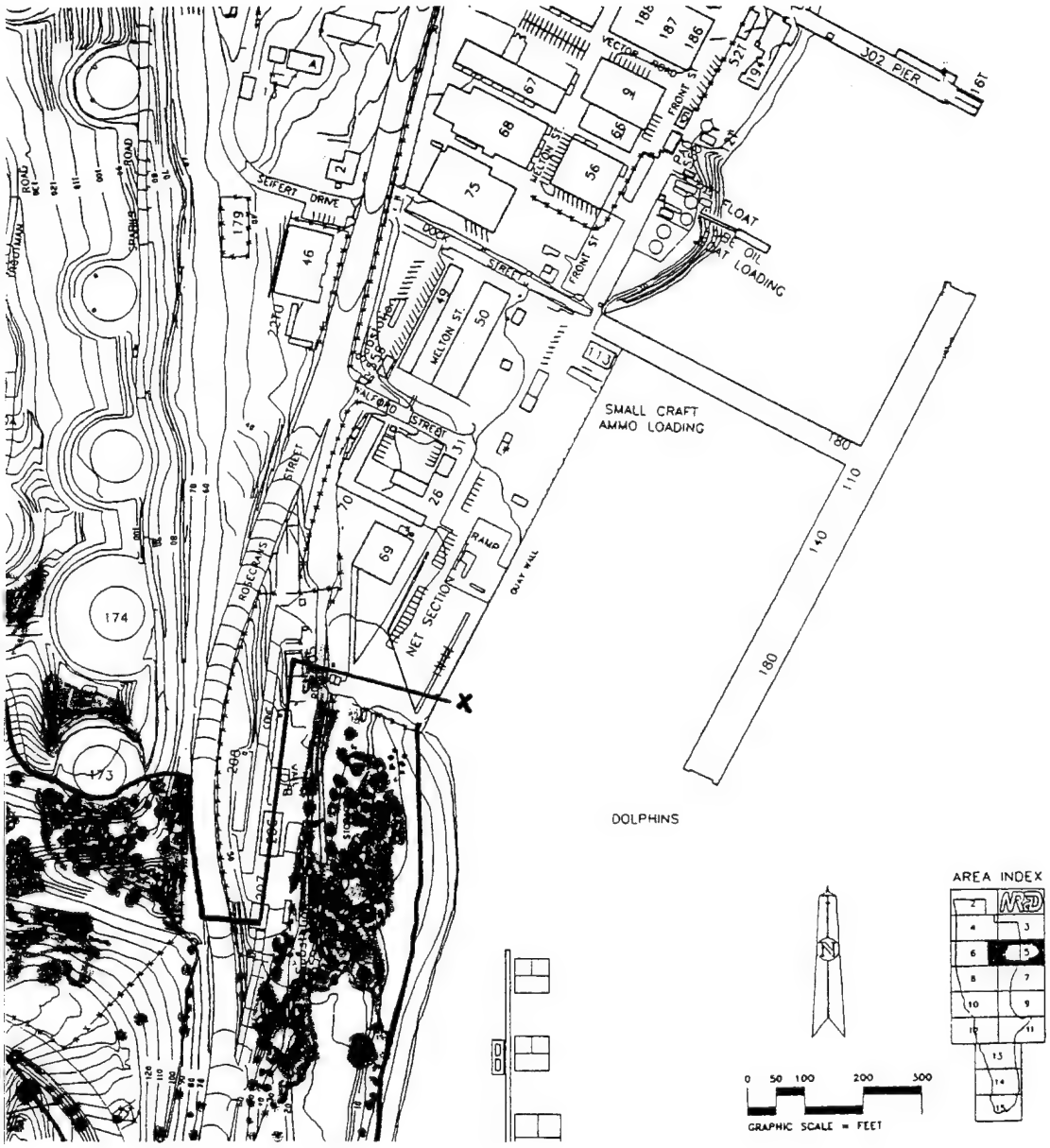
= Chrysanthemum sp.: Turquoise indicates the presence of a species of Chrysanthemum probably from the Mediterranean regions.

H = Hypericum, a St. John's wort: A red H indicates the presence of a Hypericum; probably H. canariensis from the Canary Islands.

= Other: Yellow indicates exotic species not discussed in detail in text. Four capital letters indicate either the first two letters of a binomial or of a genus. See the following key:

SCMO = Schinus molle, the Peruvian pepper tree from S. America.
SCTE = S. tenebinthifolius, the Brazilian pepper from S. America.
CYDA = Cynodon dactylon, Bermuda grass from Africa.
SAAP = Salvia apiana, white sage; a misplaced native from California.
PHOE = Phoenix, a date palm from Africa
PINU = Pinus, pine tree
ALNU = Alnus, a phreatophytic (high water using) non-native tree.

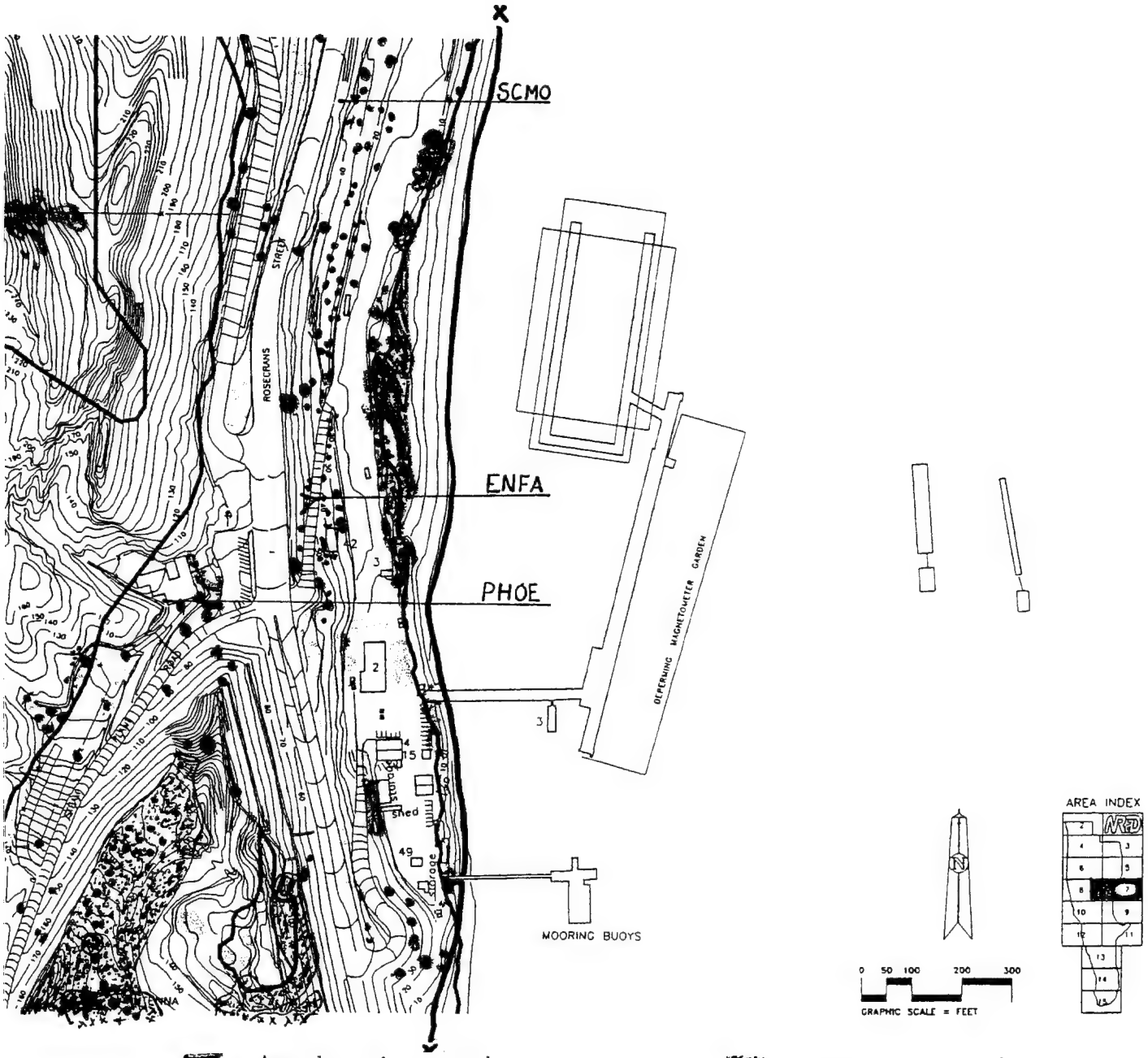
- Carpobrotus, iceplant
- Acacia, wattle
- Eucalyptus, gum tree
- Foeniculum, wild fennel
- Nicotiana, tree tobacco
- Arundo, giant reed
- Cortaderia, jubata or p
- Ricinus, castor bean
- Myoporum, myoporum
- Caesalpinia, tara



- Arundo, giant reed
- Cortaderia, jubata or pampas grass
- Ricinus, castor bean
- Myoporum, myoporum
- Caesalpinia, tara

- Centaurea, tocalote, a star-thistle
- Chrysanthemum sp.
- H - Hypericum, a St. John's wort
- Other (see appendix legend)


X
CABRILLO MEMORIAL DRIVE
ROSECRANS STREET
PINU
PHOE
X
- Carpobrotus, iceplant
- Acacia, wattle
- Eucalyptus, gum tree
- Foeniculum, wild fennel
- Nicotiana, tree tobacco
- Arundo, gia
- Cortaderia,
- Ricinus, ca
- Myoporum, m
- Caesalpinia



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- Chrysanthemum sp.
- H - Hypericum, a St. John's wort
- Other (see appendix legend)

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- Acacia, wattle
- Eucalyptus, gum tree
- Foeniculum, wild fennel
- Nicotiana, tree tobacco
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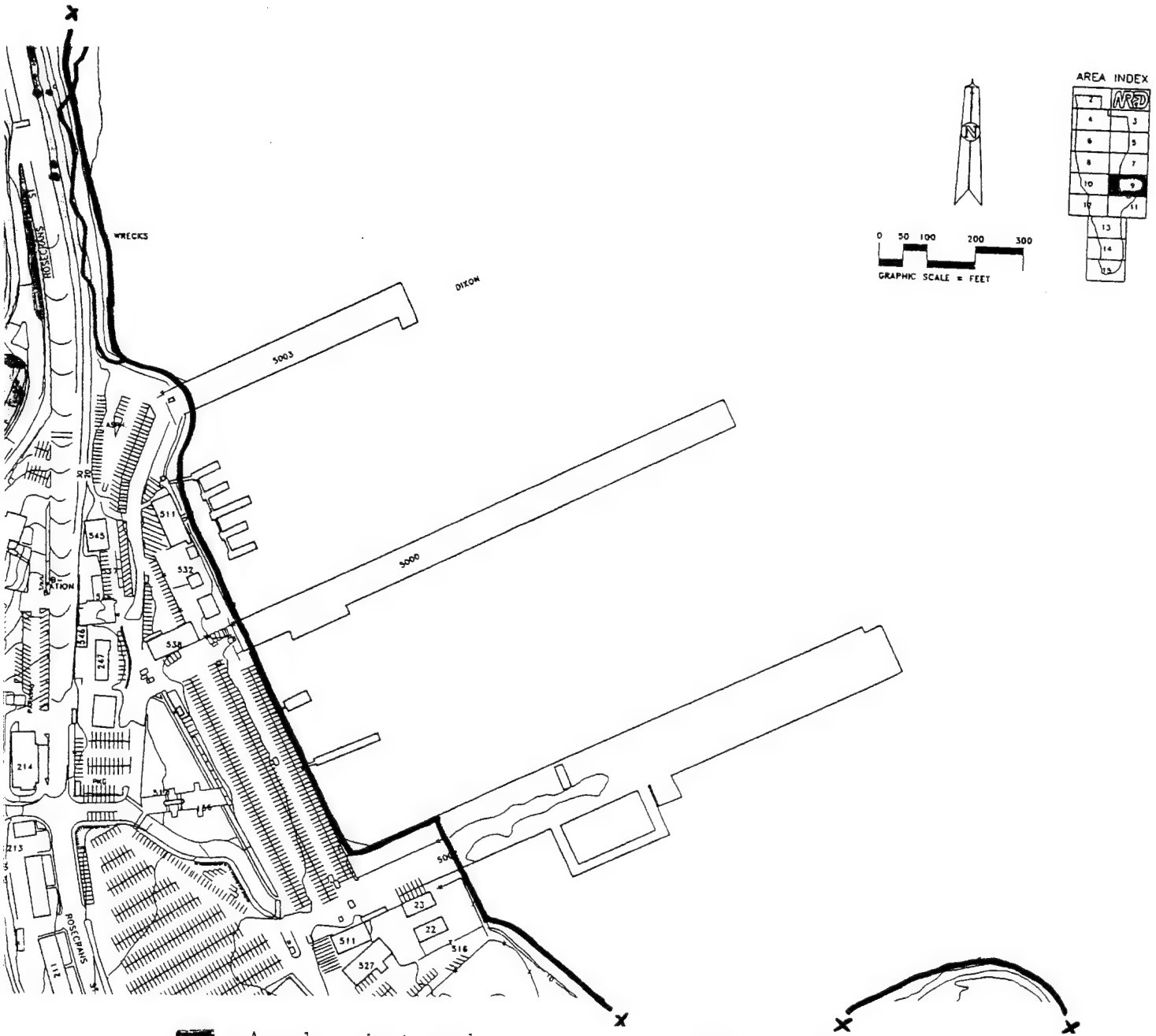
- Caesalpinia,



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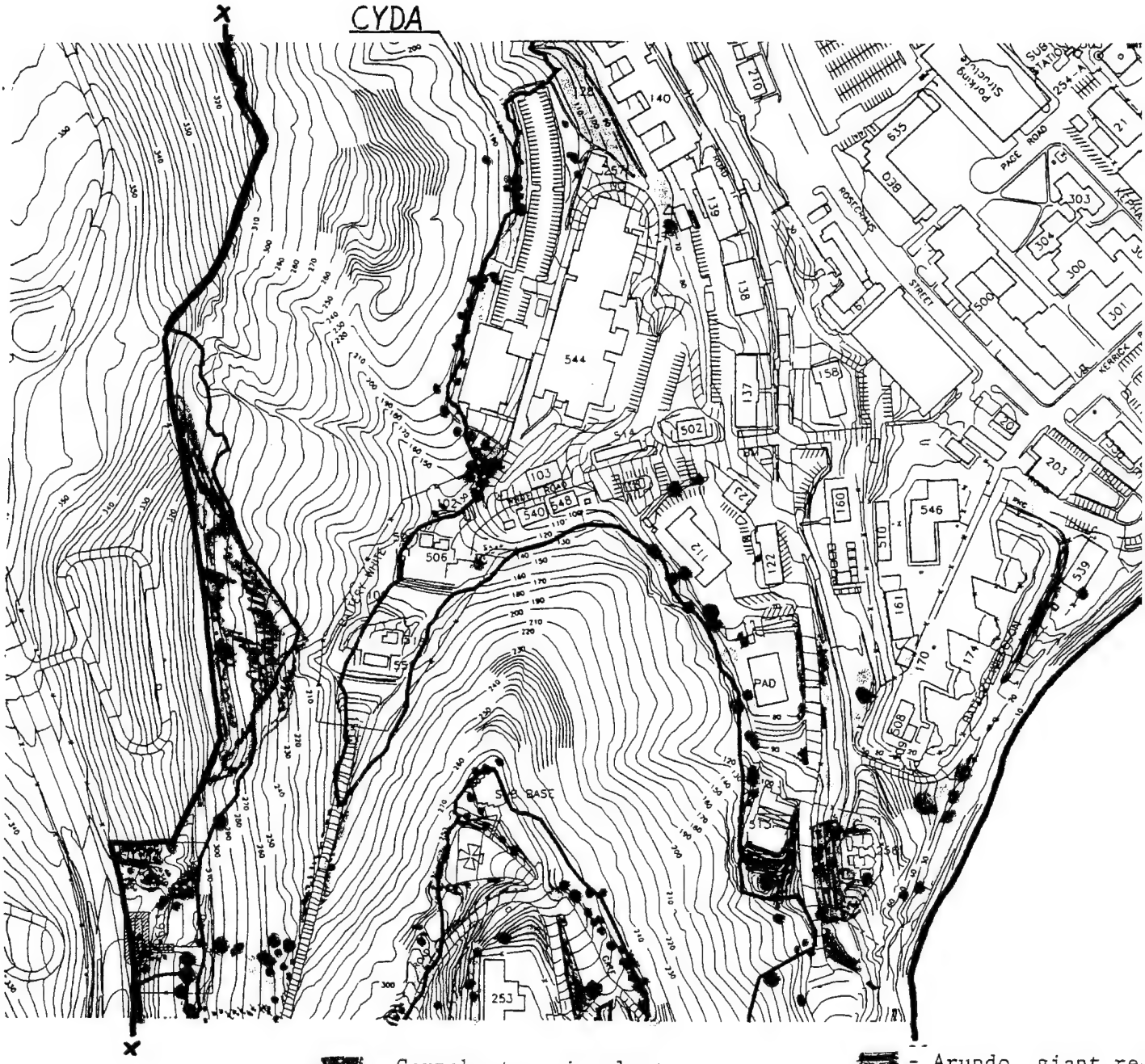
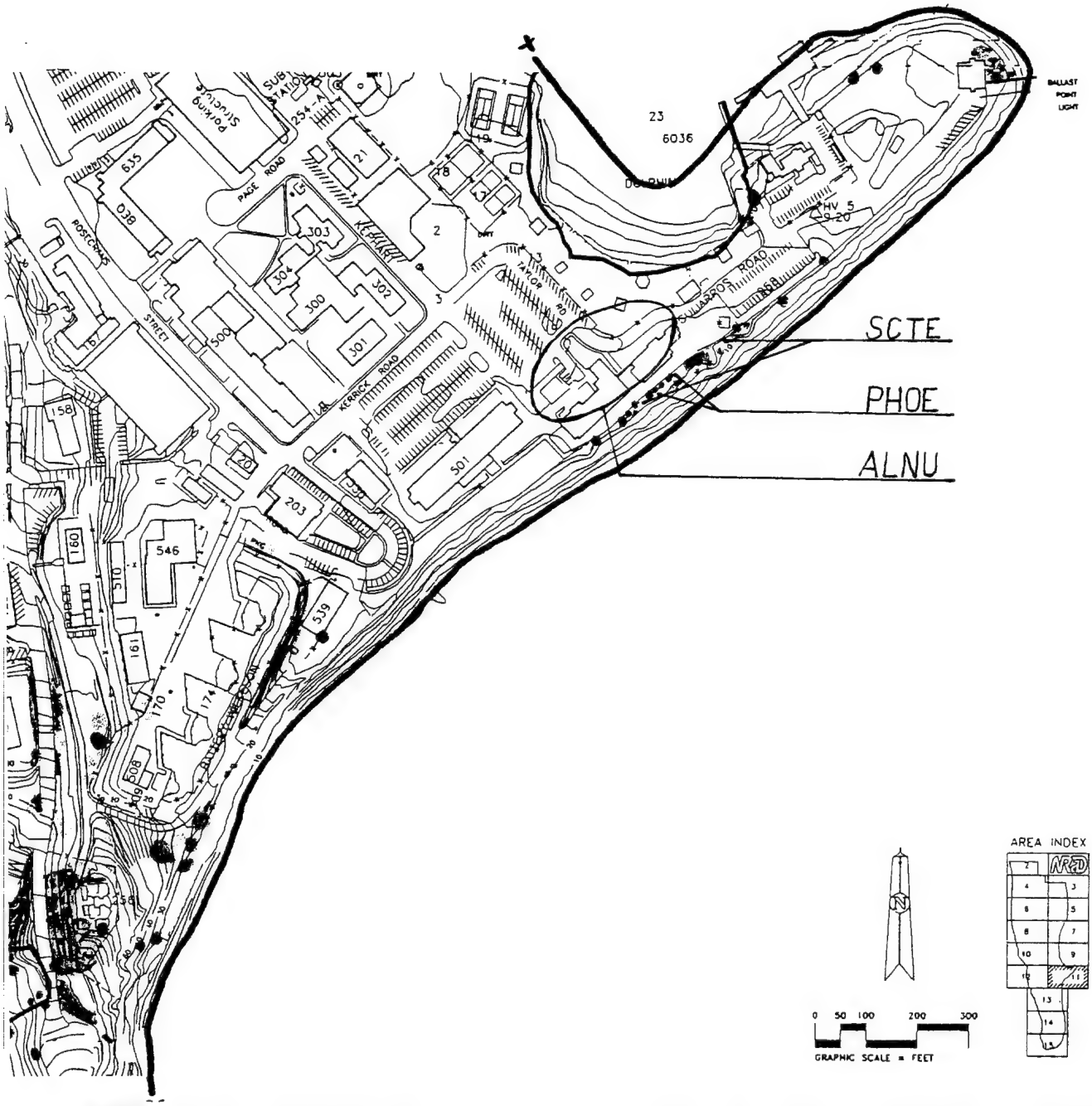
- Other (see appendix legend)



- Carpobrotus, iceplant
- Acacia, wattle
- Eucalyptus, gum tree
- Foeniculum, wild fennel
- Nicotiana, tree tobacco
- Arundo, giant re
- Cortaderia, juba
- Ricinus, castor
- Myoporum, myopor
- Caesalpinia, tar



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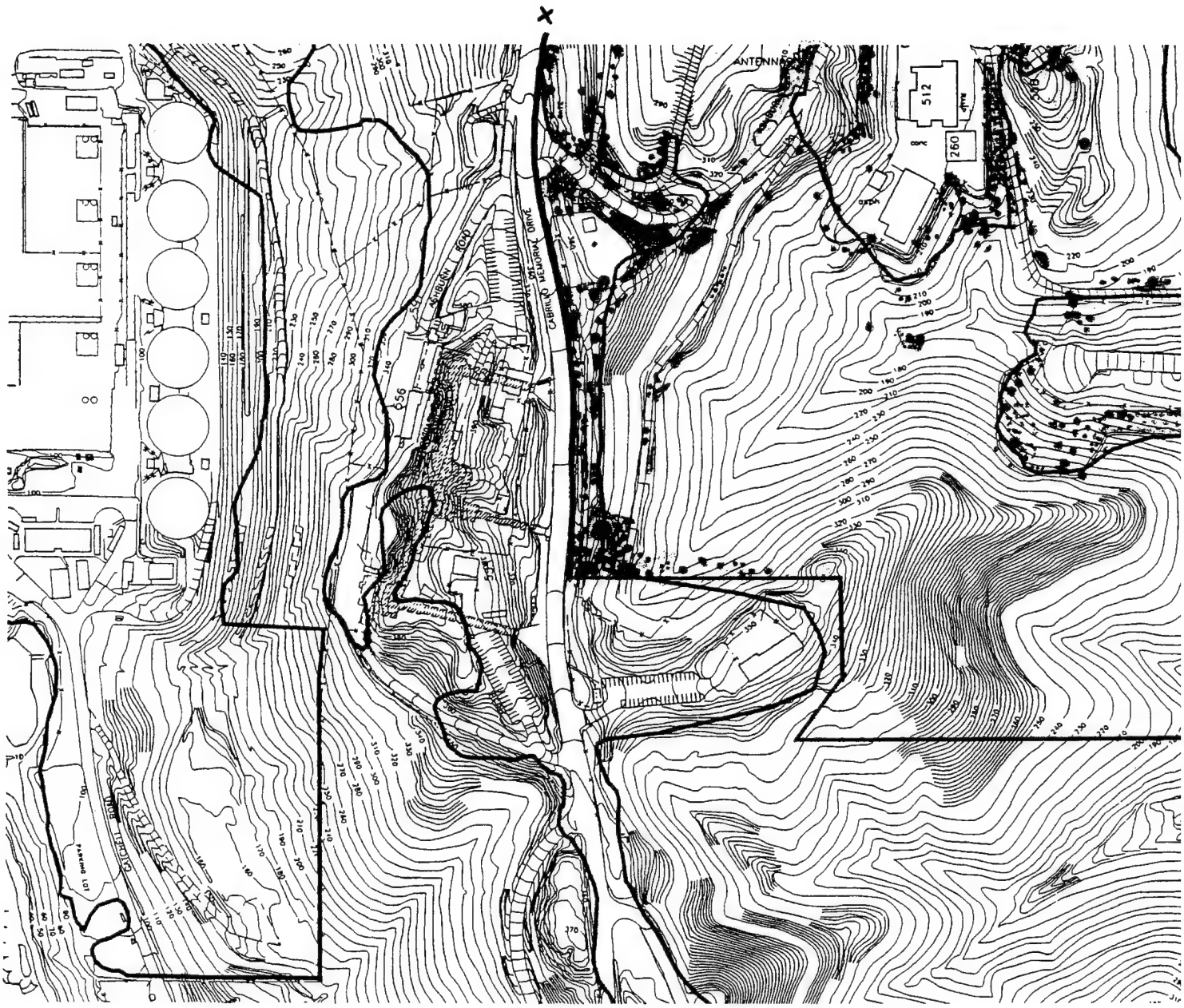

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- Eucalyptus, gum tree
- Foeniculum, wild fennel
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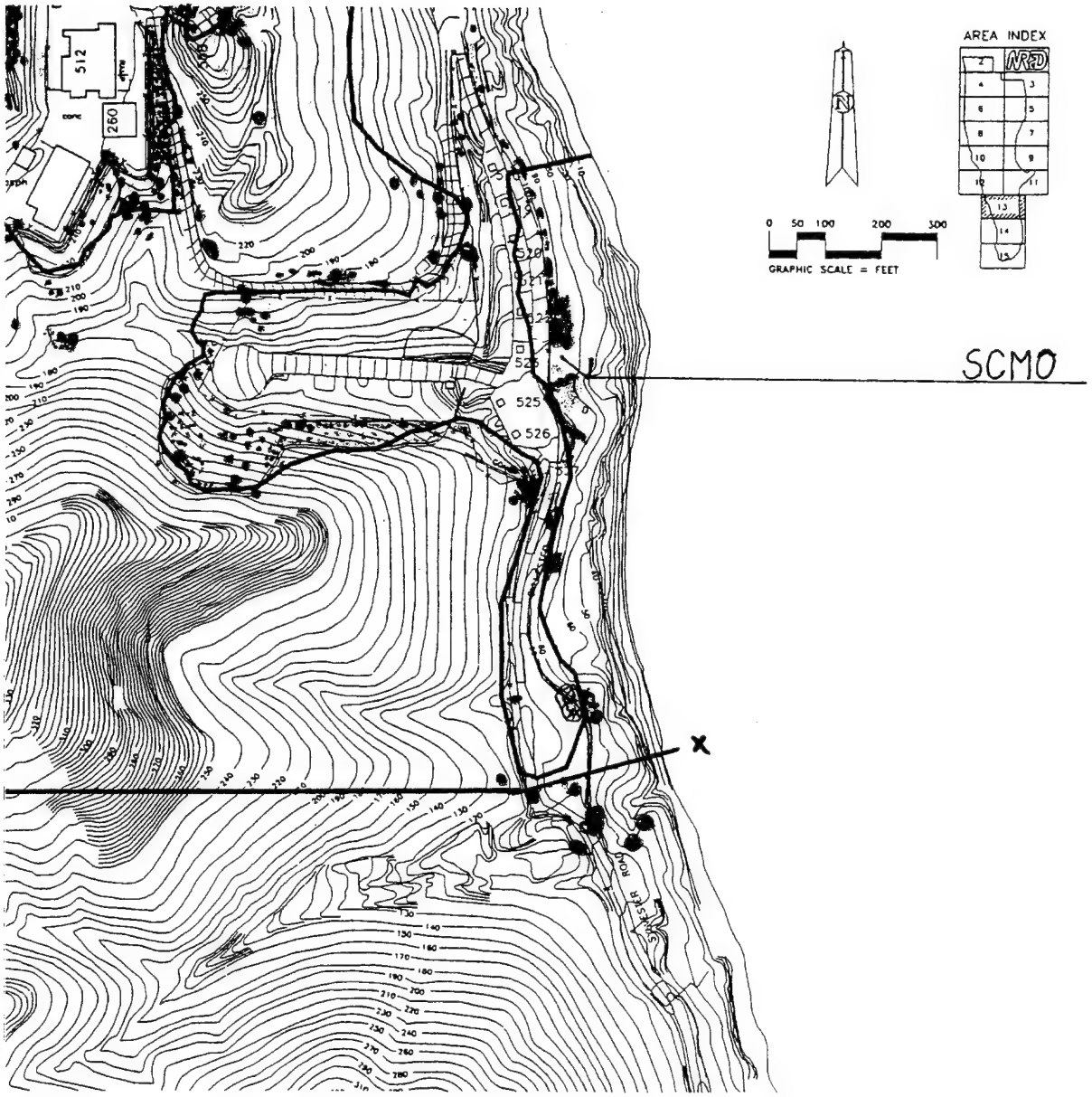
- Ricinus, castor bean
- Myoporum, myoporum
- Caesalpinia, tara



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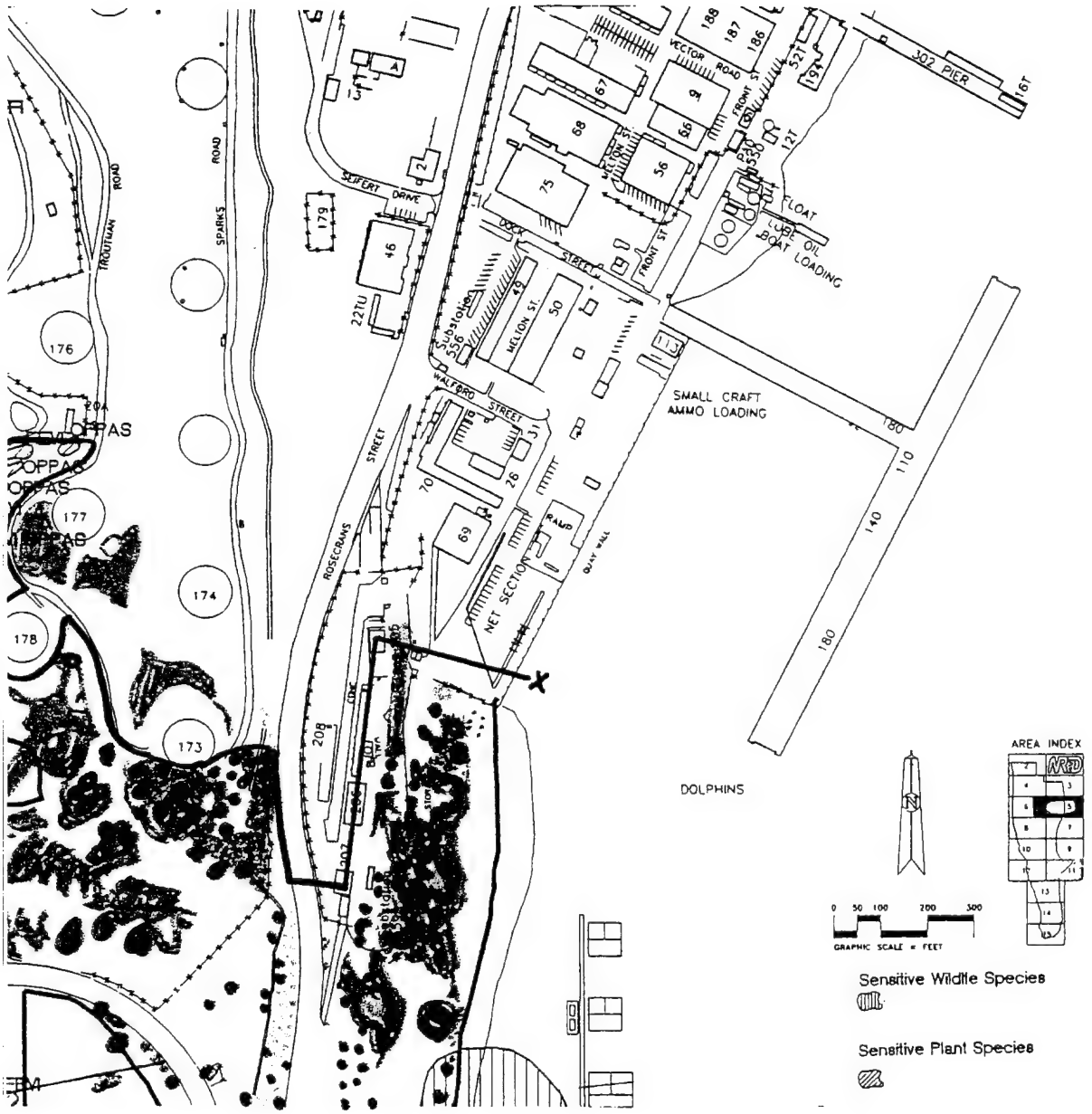
- Arundo, giant reed
- Cortaderia, jubata o
- Ricinus, castor bean
- Myoporum, myoporum
- Caesalpinia, tara



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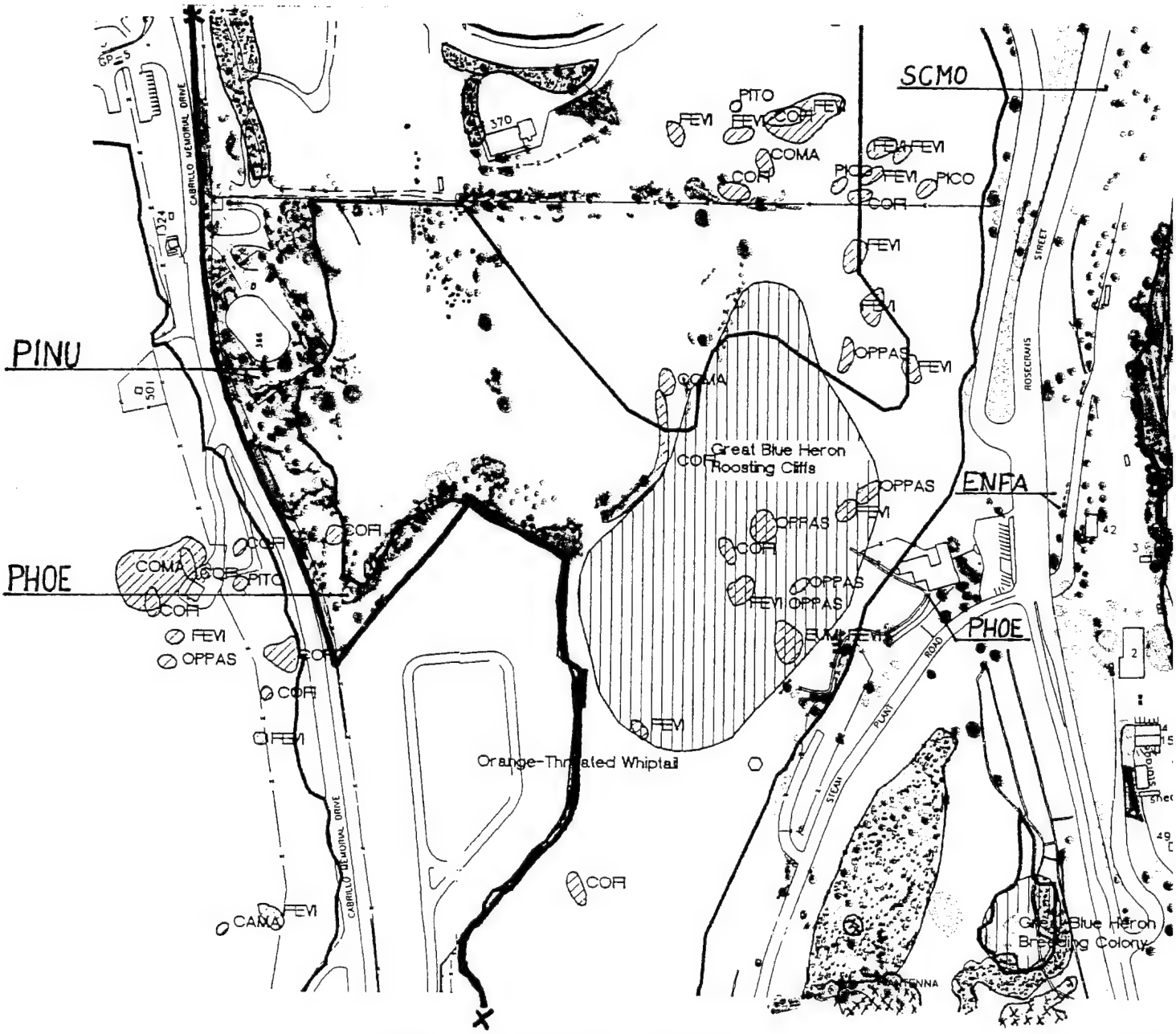

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- Acacia, wattle
- Eucalyptus, gum tree
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- Cortaderia,
- Ricinus, cast
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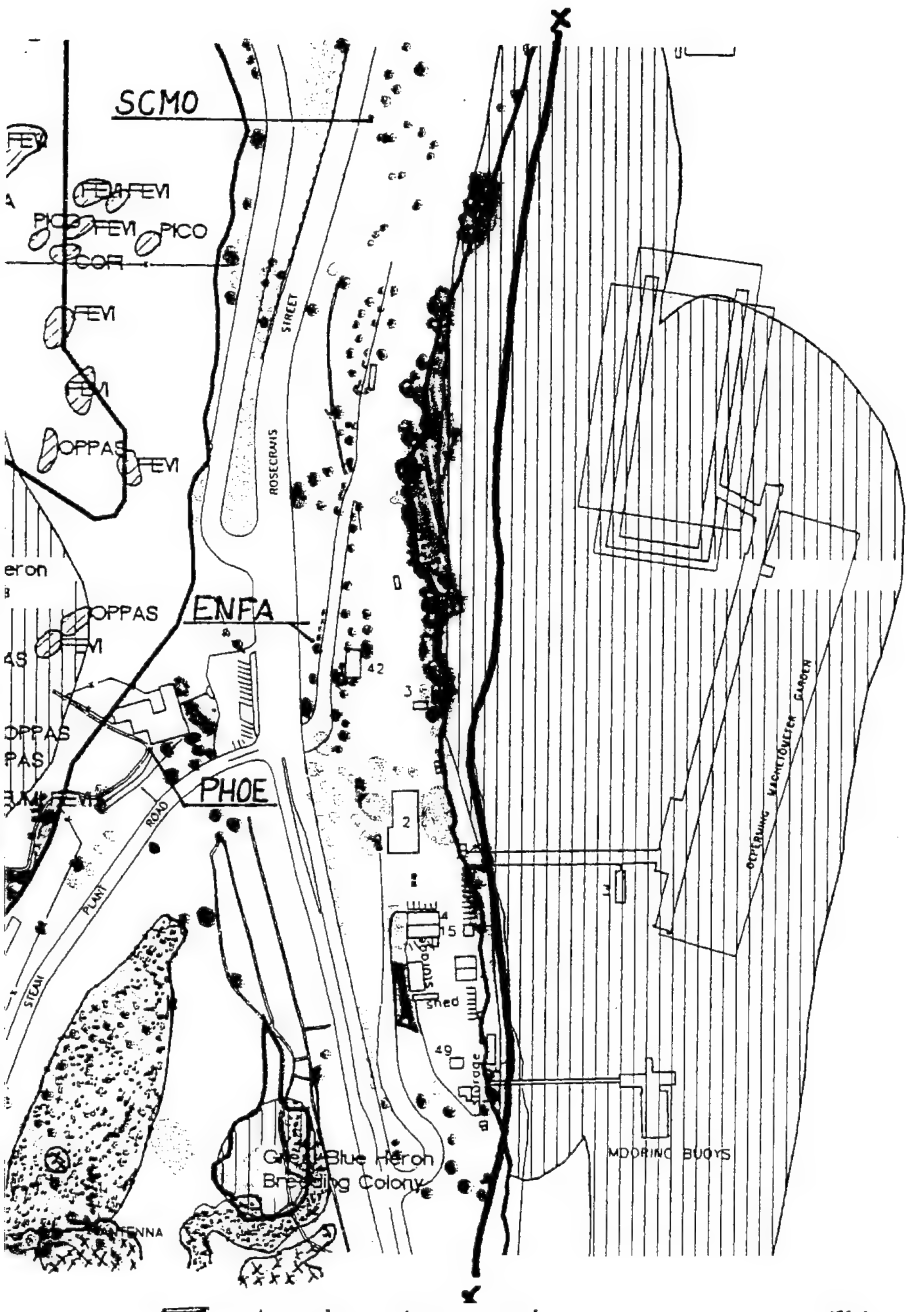
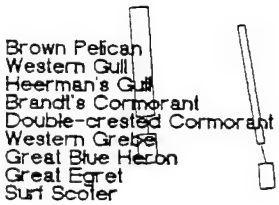
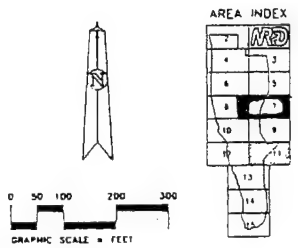
- Caesalpinia,



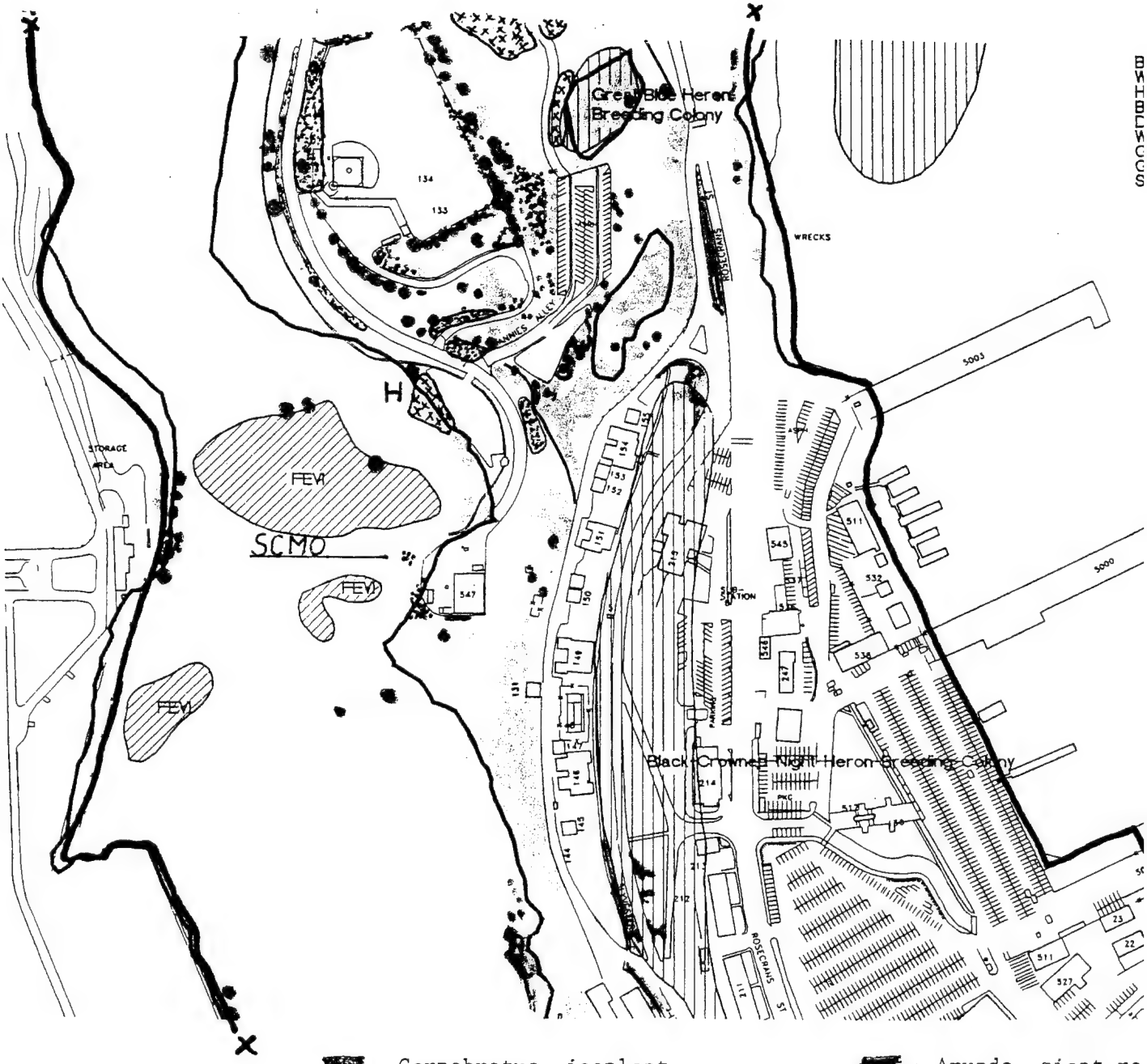




Sensitive Wildlife Species

Sensitive Plant Species

- Arundo, giant reed
- Cortaderia, jubata or pampas grass
- Ricinus, castor bean
- Myoporum, myoporum
- Caesalpinia, tara
- Centaurea, tocalote, a star-thistle
- Chrysanthemum sp.
- Hypericum, a St. John's wort
- Other (see appendix legend)



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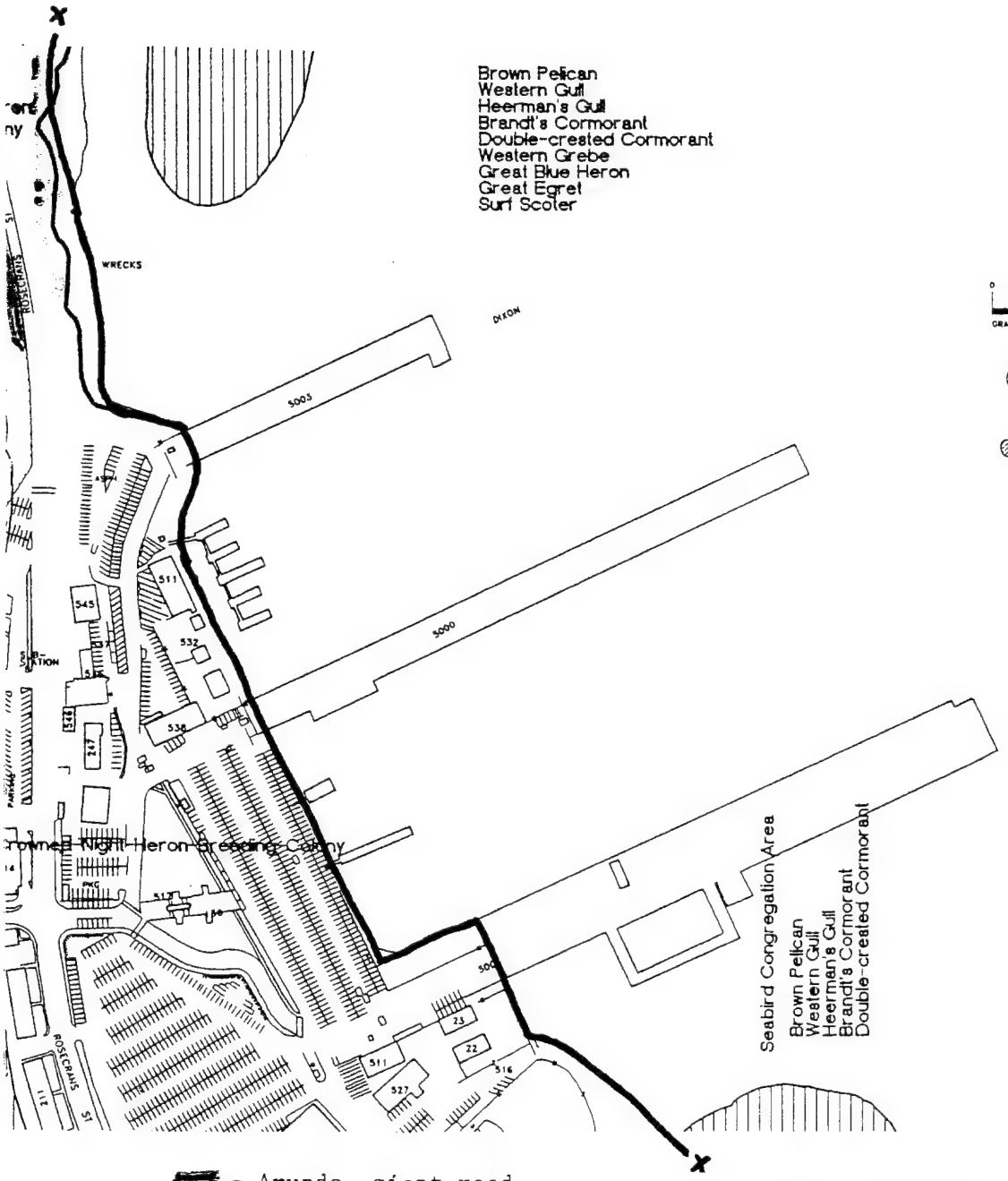

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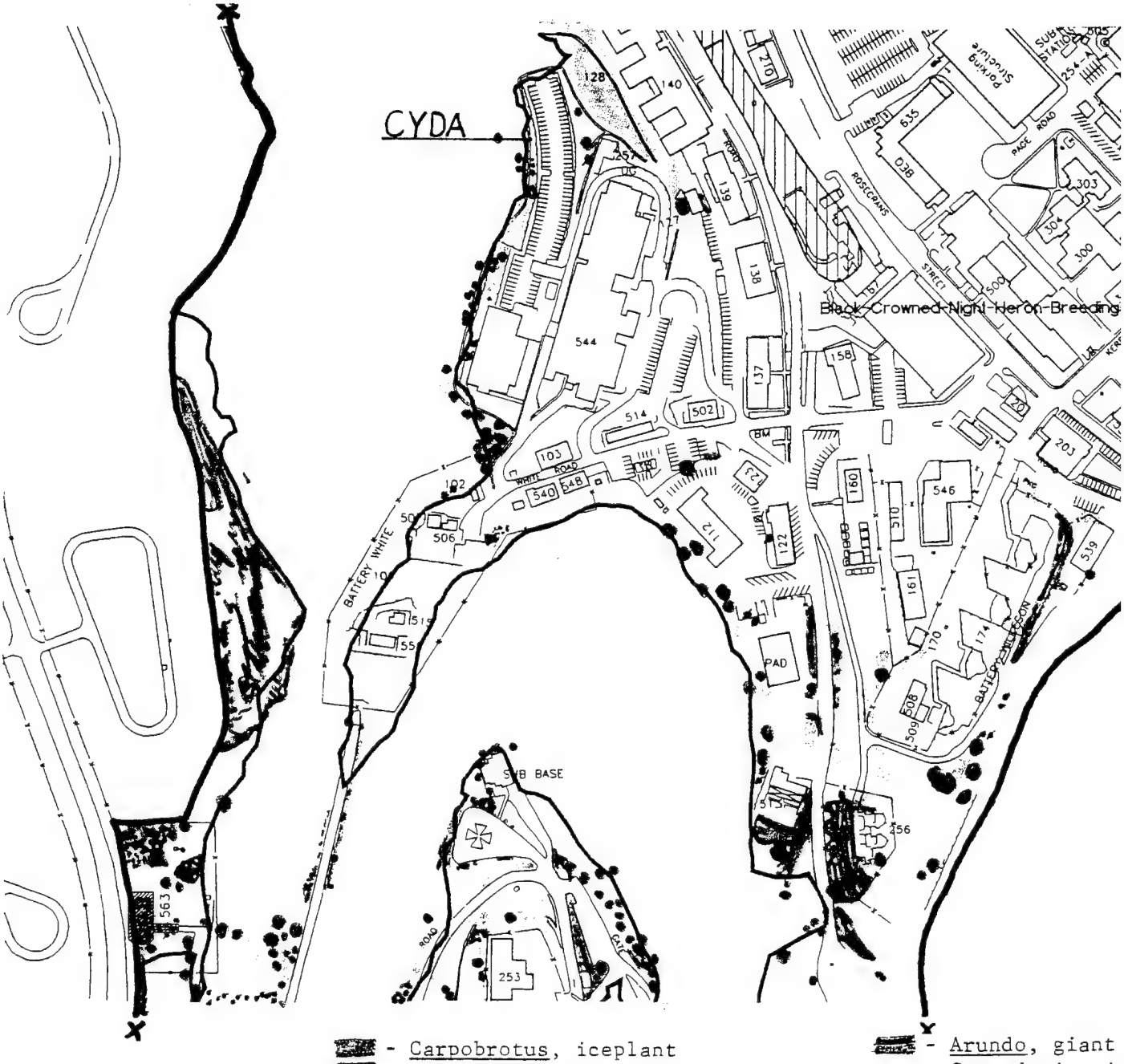
CYDA
Black-Crowned-Night-Heron-Breeding
SUB BASE
PAD
BATTERY WHITE
WHITE ROAD
ROSECRANS
PAGE ROAD
STREET
- Carpobrotus, iceplant
- Acacia, wattle
- Eucalyptus, gum tree
- Foeniculum, wild fennel
- Nicotiana, tree tobacco
- Arundo, giant
- Cortaderia, ju
- Ricinus, caste
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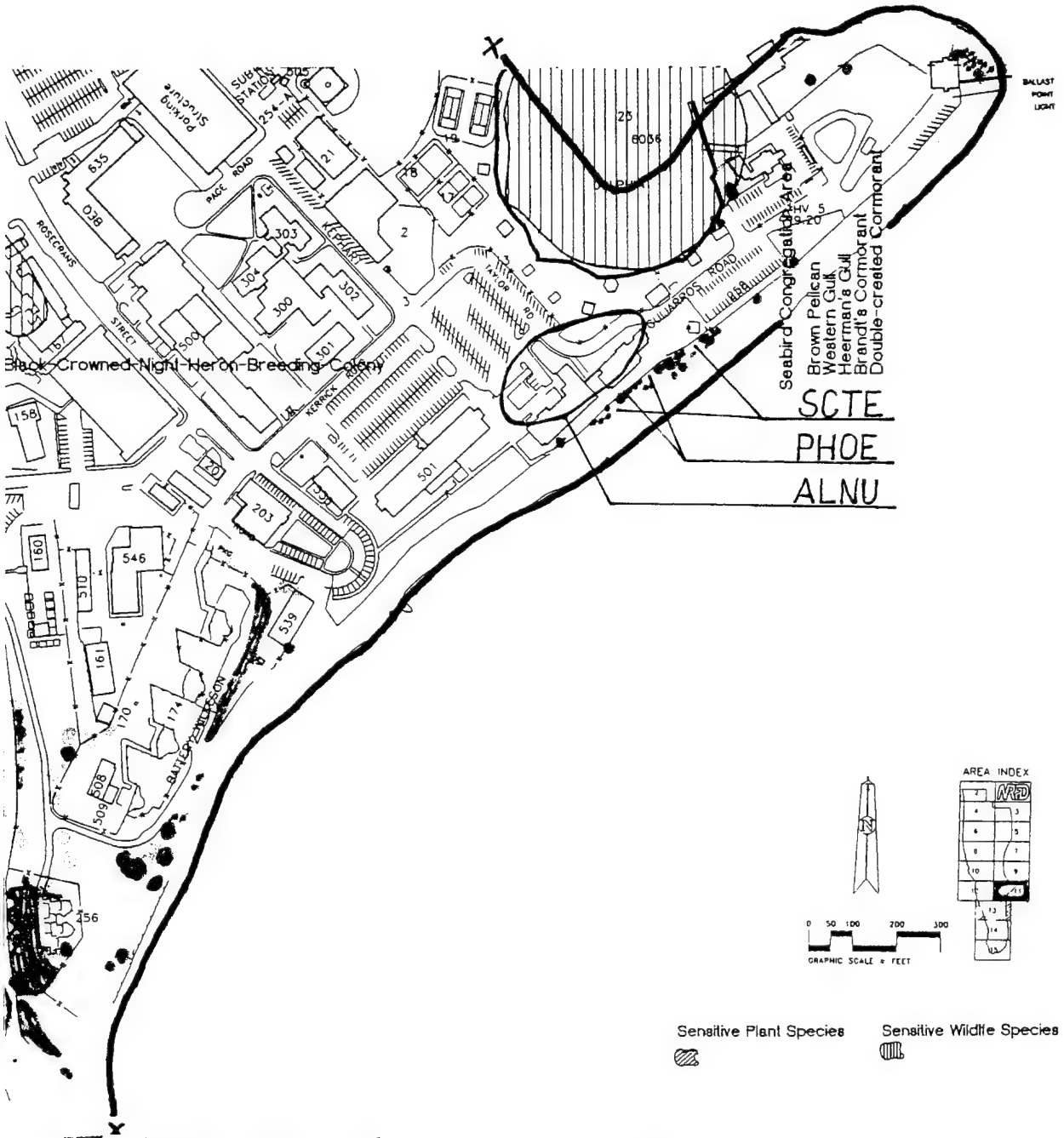
- Caesalpinia,



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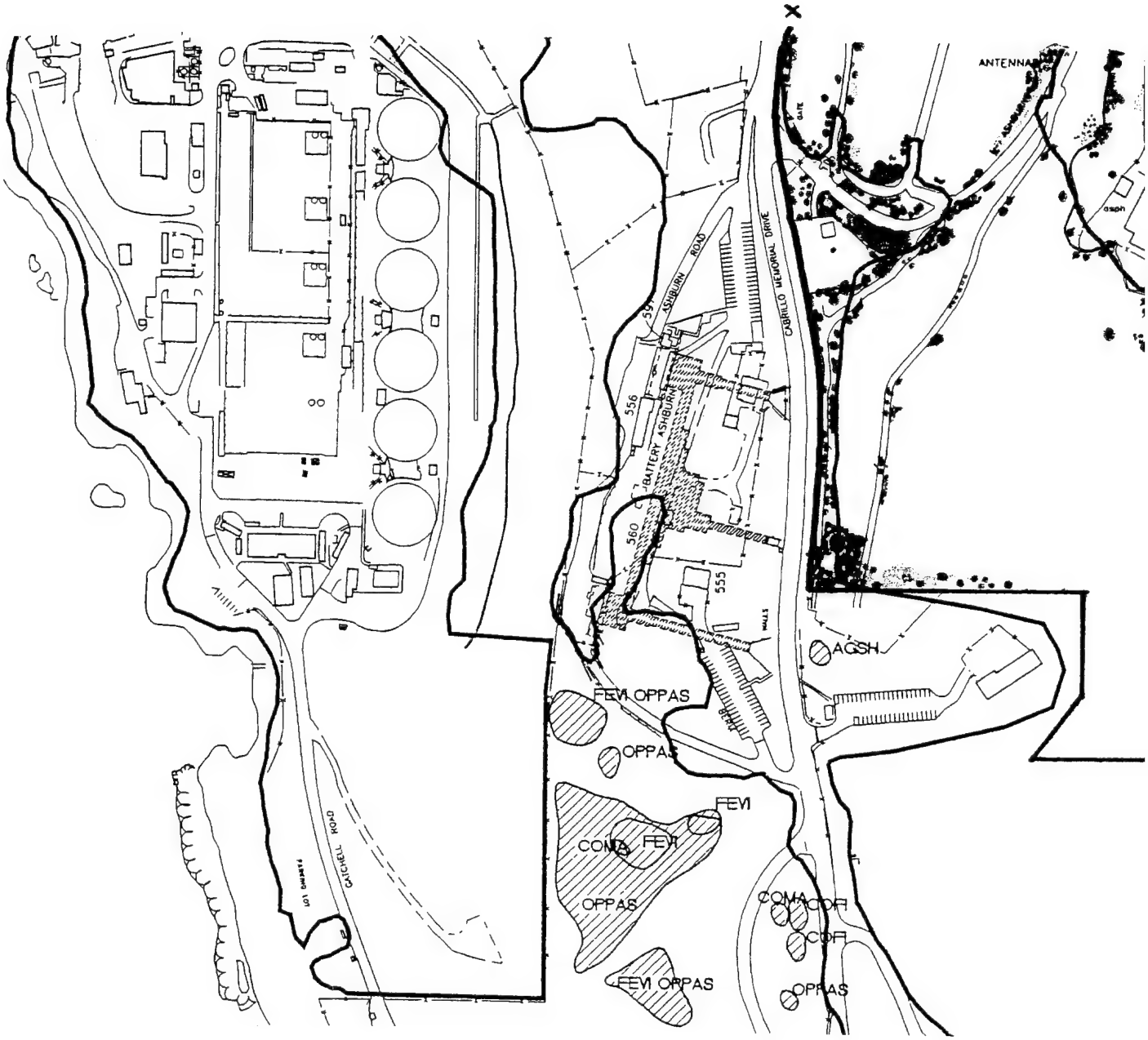

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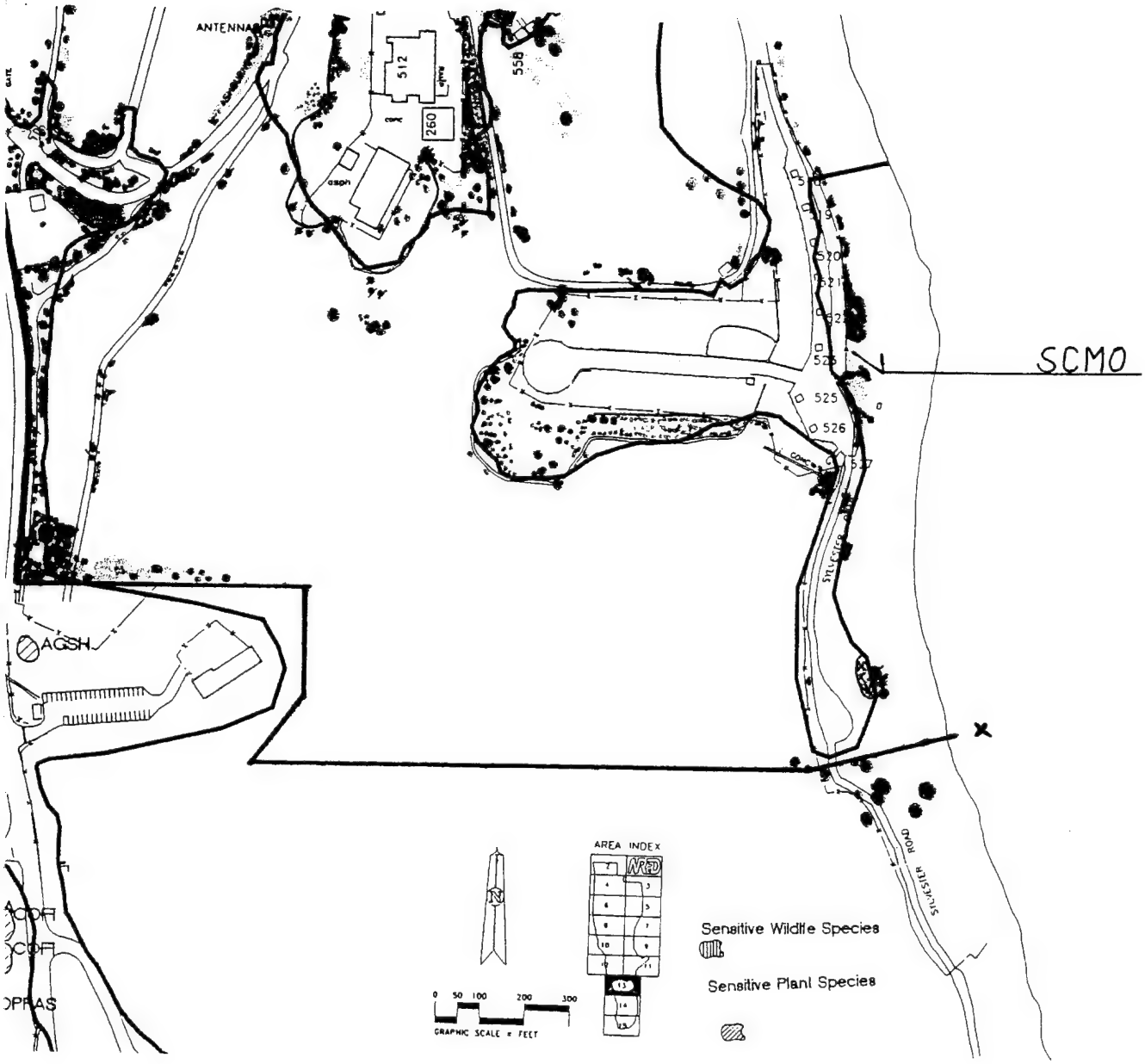

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- Chrysanthemum sp.
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Appendix E- White House Memo of 26 April 1994: Landscaping with native plants on federal grounds and federal projects.

(Full text of presidential memo)

The White House
Washington
April 26, 1994

MEMORANDUM FOR HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

SUBJECT: Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds

The Report of the National Performance Review contains recommendations for a series of environmental actions, including one to increase environmentally and economically beneficial landscaping practices at Federal facilities and federally funded projects. Environmentally beneficial landscaping entails utilizing techniques that complement and enhance the local environment and seek to minimize the adverse effects that the landscaping will have on it. In particular, this means using regionally native plants and employing landscaping practices and technologies that conserve water and prevent pollution.

These landscaping practices should benefit the environment as well as generate long-term cost savings for the Federal Government. For example, the use of native plants not only protects our natural heritage and provides wildlife habitat, but also can reduce fertilizer, pesticide, and irrigation demands and their associated costs because native plants are suited to the local environment and climate.

Because the Federal Government owns and landscapes large areas of land, our stewardship presents a unique opportunity to provide leadership in this area and to develop practical and cost-effective methods to preserve and protect that which has been entrusted to us. Therefore, for Federal grounds, Federal projects, and federally funded projects, I direct that agencies shall, where cost-effective and to the extent practicable:

(a) use regionally native plants for landscaping;

(b) design, use or promote construction practices that minimize adverse effects on the natural habitat;

(c) seek to prevent pollution by, among other things, reducing fertilizer and pesticide use, using integrated pest management techniques, recycling green waste, and minimizing runoff. Landscaping practices that reduce the use of toxic chemicals provide one approach for agencies to reach reduction goals established in Executive Order No. 12856, "Federal Compliance with Right-To-Know Laws and Polution Prevention Requirements";

(d) implement water-efficient practices, such as the use of mulches, efficient irrigation systems, audits to determine exact landscape water-use needs, and recycled or reclaimed water and the selecting and siting of plants in a manner that conserves water and controls soil erosion. Landscaping practices, such as planting regionally native shade trees around buildings to reduce air conditioning demands, can also provide innovative measures to meet the energy consumption reduction goal established in Executive Order No. 12902, "Energy Efficiency and Water Conservation at Federal Facilities"; and

(e) create outdoor demonstrations incorporating native plants, as well as pollution prevention and water conservation techniques, to promote awareness of the environmental and economic benefits of implementing this directive. Agencies are encouraged to develop other methods for sharing information on landscaping advances with interested nonfederal parties.

In order to assist agencies in implementing this directive, the Federal Environmental Executive shall:

(a) establish an interagency working group to develop recommendations for guidance, including compliance with the requirements of the National Environmental Policy Act, 42 U.S.C. 4321, 4331-4335, and 4341-4347, and training needs to implement this directive. The recommendations are to be developed by November 1994; and

(b) issue the guidance by April 1995. To the extent practicable, agencies shall incorporate this guidance into their landscaping programs and practices by February 1996.

In addition, the Federal Environmental Executive shall establish annual awards to recognize outstanding landscaping efforts of agencies and individual employees. Agencies are encouraged to recognize exceptional performance in the implementation of this directive though their awards programs.

To enhance landscaping options and awareness, the Department of Agriculture shall conduct research on the suitability, propagation, and use of native plants for landscaping. The Department shall make available to agencies and the public the results of this research.

[signed]

William J. Clinton

Appendix F- Arborist's Report on Tree Growing for Heron Mitigation Habit, 1994

PT. LOMA SUB BASE
SAN DIEGO, CALIFORNIA

ARBORIST REPORT
CONTRACT NO. N66001-94-M-3211

Prepared for:
NATURAL RESOURCES BRANCH
ENVIRONMENTAL DEPT.
NAVAL SUBMARINE BASE
San Diego, California

Attention:
Mr. Chris Grunewald

Report Prepared by:
Mark Wisniewski

September 26, 1994

WISNIEWSKI & ASSOCIATES - LANDSCAPE ARCHITECT - CERTIFIED ARBORIST
315 First Street, Suite U #216 - Encinitas, California 92024
(619) 436-5308 - FAX (619) 943-8665
Licensed Landscape Architect No. 3281
International Society of Arboriculture - Certified Arborist No. WC-0742

Wisniewski & Associates Project No. 94-0015

ERRATA

NOTE: This page should be attached to the Arborist Report dated September 26, 1994.

ADD:
2.11 The grading that has occurred on the mesa consisted of both cutting and filling. The grove of *Eucalyptus sideroxylon* are reportedly located on a part of the mesa that was filled.

REVISE:
2.31 The site is part of the area designated the Point Loma Ecological Reserve Area for Great Blue Heron nesting and for other native plant an danimal species.

REVISE:
4.10 c) Several successful nests have been observed to occur in *P. torreyana* at NCCOSC RDTE and at the corner of Owens and Rosecrans Street in Point Loma.

ADD:
5.11 The anticipated crown spread at maturity of the trees is 35-50 feet for *E. cladocalyx* and 25-40 feet for *P. torreyana*. (Perry B., 1992, p170 and 247).

ADD (after chart):
8.10 NOTE: The historical and current ETo rates and computer access can be obtained by requesting CIMIS (California Irrigation Management Information System) information from:

DWR Office of Water Conservation
P.O. Box 942836
Sacramento, CA 94236-0001.

Additional Note: This project was contracted by NCCOSC RDTE DIV 521. The contact person was Mary F. Platter-Rieger.

Contract No. N66001-94-M-3211

TABLE OF CONTENTS

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2.0 Site....2

3.0 Constraints/Requirements....4

4.0 Species Selection....5

5.0 Planting Design/Layout....6

6.0 Planting Stock....7

7.0 Planting Recommendations....8

8.0 Maintenance Recommendations....11

9.0 Existing Tree Recommendations....14

10.0 Additional Recommendations....15

Bibliography....17

Photographs:
Figures 1-5

Attachments:
1) "Watering Trees" by Mark Wisniewski, Reprint from People for Trees Newsletter, Summer, 1993.
2) "Pruning Young Trees" by Alden Pedersen, Reprint from People for Trees Newsletter, Spring, 1993.

1.0 PROJECT DESCRIPTION

The purpose of this Arborist Report is to provide recommendations for the selection, planting, and maintenance of trees required for mitigation due to the destruction of Great Blue Heron *Ardea herodias* nesting sites fourteen years ago.

There are plans for an interim mitigation requiring the construction of steel towers that have a life expectancy of forty years. At that time the towers will be removed.

1.10 The permanent mitigation requires the establishment of trees with the appropriate branch configurations for potential nesting sites at an elevation of 50' above the ground plane. The potential nesting sites are to be established prior to the removal of the towers in forty years.

2.0 SITE EVALUATION

The proposed mitigation site was visited on August 8, 1994. The author was accompanied on the visit by Mary Platter-Rieger, a Terrestrial and Marine Biologist with the Marine Environmental Branch of NOSC, and Chris Grunewald, the Natural Resources Manager for the Sub Base.

2.10 The site is a primarily east by southeast facing slope. The site encompasses approximately 5 acres. The slope is traversed by several unpaved roads, only one of which appears to have had any recent traffic, and that mainly from the dumping of soil and landscape gardening debris on the site. Additionally there are some relatively flat benches. The top of the slope is a mesa that appears to have been graded several years ago (Figure 1).

2.20 There is erosion occurring on the graded mesa, with large holes where water has entered animal burrows (Figure 2). The slope adjacent to the mesa has an eroded face and a series of cracks parallel to the slope that indicate slope movement. Some portions of the slope show signs of occasional sloughing and failure. Water movement over the edge of the mesa has caused erosion down the face of the slope, with the deposition of soil on the lower benches.

2.30 The majority of the slope is vegetated with annual grasses and plants typical of the coastal sage scrub community. Some exotics are intermingled with the native plants. The top of the mesa is predominantly bare soil.

2.31 The site is designated the Point Loma Ecological Reserve Area for Great Blue Heron nesting and for other native plant and animal species.

2.32 Existing trees, all of which are not native to California include the following:

Eucalyptus cladocalyx (Sugar Gum) congregate in a grove of mature trees in the approximate middle of the site (Figure 3). Some of these trees already have both active and abandoned Great Blue Heron nests, while other trees nearby do not have any evidence of nest building activity (Figure 4).

Eucalyptus camaldulensis (Red Gum), identified by M. Platter-Rieger, occur in a large grove northeast of Steam Plant Parking Lot #2 (Figure 5). The trees are

spindly and open. Height is a maximum of 20-25'. No evidence of nesting has been observed. The branch structure did not appear to be sufficient to support the size and weight of Great Blue Heron nests. Several dead trees occur in this area. The ultimate size and growth habit of these trees (Hogan, 1988) indicates that these could be considered candidates for nesting trees. Observations of the grove over many years by Platter-Reiger suggests that no strong structural branches have developed and their slow rate of growth have given no indications that their normal ultimate size will be achieved on this site.

Eucalyptus sideroxylon (Red Ironbark) appear to have been planted within the last 5 years in groups along the top of the mesa. This species normally does not develop the height and the necessary branch structure in this area, that would support nesting activities.

2.33 Signs of potentially damaging animal activity include burrowing from ground squirrels, cottontail rabbits and gophers. The burrowing also has a beneficial aspect of cultivating and aerating the soil. Cottontail rabbits, as well as mice, can also damage young seedlings by gnawing on and girdling the trunks.

2.40 The soil appears primarily to be a sandy silty loam, with occasional cobble stones. The soils on the roads and mesas are compacted, while in the open areas a soil probe readily penetrated to 12" deep. Platter-Rieger reported that past soil tests in nearby locations showed nitrogen to be deficient and had a pH level of 6.5 in locations where the soil was exposed while samples under native vegetation had a pH of 4.5.

2.50 Above-ground structures in the area include a cable tower that requires a clear line of site to North Island for proper operation. A concrete brow ditch occurs below the main bench. The concrete is cracked in some locations. Steam Plant Parking Lot #2, which is paved with asphalt, is located above an abandoned road. The road is suitable for planting.

2.60 No below-ground structures were identified.

2.70 No future construction is planned for the area with the exception of the temporary nesting towers and the possibility of some erosion control work on the mesa.

2.80 The mesa has an identified area of historical significance, the site of a barn and corral. Note that soils in the immediate area or downslope may show some micronutrient deficiencies. "In the United States. old livestock corrals and Indian burial sites are commonly deficient in both copper and zinc; these elements are apparently tied up by the combination of certain organic matter and soil compaction." (Harris, 1983).

2.81 Prior to any planting site designations, the entire site should be surveyed by a cultural resources specialist, a historian and/or an archaeologist to determine if any areas are to be avoided for planting consideration.

2.90 The site is protected from prevailing on-shore winds by a high ridge that leads to Point Loma, but may be subject to hot, drying late summer and early fall Santa Ana winds from the east.

3.0 CONSTRAINTS/REQUIREMENTS

The ultimate success of the proposed tree planting is subject to the vagaries and extremes of nature and weather that cannot always be anticipated.

3.10 New diseases, insect pests or other pathogens may occur for which there may not be any suitable defenses or treatment.

3.20 Unseasonable or unusual weather patterns may occur that may have either a direct or indirect negative effect on the trees' performance or survival. Prolonged regional drought may affect the availability of water for landscape maintenance.

3.30 Brush fires may occur in the area that can damage or kill the trees, depending on their condition and stage of growth and maturity.

3.40 Continued erosion can have a negative impact on individual trees or a group of trees. Slope failures or earthquakes may be damaging or lethal to the trees located near the edge of the slopes.

3.50 Environmental pollution may reach levels that have a damaging effect on the trees.

3.60 Construction and deconstruction of the towers, due to ground disturbance and/or compaction, may have a negative impact on the existing trees, as well as those trees planted as part of the mitigation efforts.
The towers should not be located in areas that are most suitable and accessible for tree planting.

3.61 Extreme care should be exercised to avoid damage to existing healthy trees, particularly to their root systems (Hagen, 1989). The system of so-called "'transport' roots frequently extends to encompass a roughly circular area four to seven times the area delineated by an imaginary downward projection of the branch tips (the so-called drip line)" (Perry, 1992).

It is also important to note that "a significant portion of the root system of all trees in all soils is concentrated in the top few inches of soil. Tree roots grow horizontally right into the litter layer of the forest..." (Perry, 1992). That is why root protection from construction activity is so important. Roots are susceptible to damage from crushing by construction equipment and do not readily recover, but may decline over a long period of time (Rolf in Watson, 1994).

3.70 Ongoing maintenance and monitoring is critical to the success of this project. Competent trained personnel should be utilized for all aspects of tree care.

3.71 Permanent files should be kept and the data retained should include at least the following:

- the date when an activity was performed
- the weather at the time
- the species of tree
- the condition of the individual tree or trees
- what was done and why it was done
- the quantity of any materials used

- the rate at which the materials were applied (the dosage)
- the anticipated result
- the actual measured results observed at a later time
- conclusions and further recommendations based on the measured results.

3.72 **NOTE WELL: A copy of this report and all subsequent data, should be provided to any individual that is requested to perform any work or service regarding these trees so that they will have a true and complete picture of what was done, when it was done, why it was done, and what happened as a result. Without this information inadequate or damaging treatments may be prescribed that work at cross-purposes to these recommendations and subsequent work or revisions.**

4.0 SPECIES SELECTION

The tree species recommended for the mitigation planting include the following:

1. *Eucalyptus cladocalyx* .....Sugar Gum
2. *Pinus torreyana*.....Torrey Pine

4.10 The reasons for the selection of these trees are as follows:

a) Both species are growing on the Sub Base and large specimens are located within 1/2 mile of the site and are suitable for the climate, exposure and conditions at the site.

b) *E. cladocalyx* is growing on the site and has active nests currently in some trees on the proposed mitigation site. Other existing *E. cladocalyx* trees on the site are 40' tall or more and have the potential for nesting activity.

c Several successful nests have been observed to occur in *P. torreyana*. on the Sub Base.

d) Both species have a fast rate of growth under the proper conditions.

e) Individual specimens of each species can be relatively long lived.

f) New pest, disease problems, climate or environmental changes that may arise would most likely not affect both of the species to the same extent, therefore using more than one species will help to insure that some trees will survive to provide the required nesting habitat.

g) Both species can be maintained with similar practices, with the exception of pest control.

h) *E. cladocalyx* is relatively resistant to both of the two current major pests affecting eucalyptus trees: the Eucalyptus Longhorned Borer (*Phoracantha semipunctata Fab.*) (Paine, et. al., 1994?) and the Eucalyptus Snout Bettle (Shaw-personal communication) (*Gonipterus spp.* which is probably *Gonipterus scutellatus Gyll.*). (Downer 1994).

4.20 Possible negative aspects of the selection of these trees include the following:

a) The *P. torreyana*. is native to San Diego County. The eucalyptus may have a negative impact on the other native species occurring on the site which is a designated Ecological Reserve Area. The possible negative impacts have to be weighed against the positive benefits of providing nesting sites. These impacts should be evaluated by the biologist in charge of this mitigation project before the final tree species selection is completed.

b) Planting of any trees may have a negative impact on the native plants species as they compete for moisture and nutrients. Tree shading may decrease the

density and vigor of the natives over time as well.

c) The planting and watering of the trees may have a negative effect on the existing native plant community. Native plants may have to be removed in some locations to allow for soil preparation prior to planting. Watering the trees may cause fungal or other disease problems with the native plants particularly downslope of the planting sites. Higher levels of soil moisture may also accelerate any potential slope movement or localized slope failures.

d) Reducing watering, especially on the eucalyptus, (during a drought or after the trees reach the required height) if not done properly can cause severe stress to the trees and make them vulnerable to disease and insect attack (Shaw-personal communication).

4.30 The mix of trees should be as follows:

1. *Eucalyptus cladocalyx* 50%
2. *Pinus torreyana*.....50%

5.0 PLANTING DESIGN/LAYOUT

The planting sites should be designed to be randomly spaced over the entire area to replicate the feel of a natural forest setting while keeping some of the open grass areas intact. Minimize the disturbance and removal of native plant species, especially coastal sage scrub species. All planting locations are to be designated by the project biologist.

5.10 Each planting location of a single species shall consist of twelve trees planted in three groups of four trees each. Space the three groups in a roughly triangular pattern at 50' on center. Space the trees within each group in a square pattern at 5' apart. Space planting locations 100' apart.

5.20 Locate the plantings on the mesa, on the benches and on the abandoned roads. Locate the majority of trees 10-15' from the edge of slope drop-offs to take advantage of the additional height above the ground that occurs in branches that overhang slopes. Trees can increase slope stability by their root growth holding the soil together.

5.21 Locate the new plantings away from existing established trees a minimum distance equivalent to the height of the existing trees if they are to be retained. One exception is the road below Steam Plant Parking Lot #2 where the distance can be as close as 1/2 the height of the existing trees.

5.30 Keep plantings 10-15' away from actively eroding slopes, especially if there is evidence of slope failure.

5.31 Keep plantings at least 0.6 times the anticipated canopy spread at maturity away from existing parking lots to reduce the possibility of roosting birds dropping excrement onto cars parked below.

5.40 Keep plantings away from any designated historically sensitive locations.

5.50 At least one-half of the available tree planting locations should be held in reserve for long term future planting sites. It was reported (Cooper and Short, 1985)

that herons are known to destroy a grove of trees and then move on to new trees.

5.51 Personal observations of the Morro Bay, California Great Blue Heron rookery in September, 1994 confirm the presence of many dead and dying trees. One of the identified possible contributory reasons for the tree death is that the accumulation of acidic excrement over time, particularly concentrated uric acid, can leech into the soil and alter the chemical composition of the soil and the water in the soil (Beck et. al., 1992).

5.60 Advantage should be taken of natural water flow patterns on the site for the purpose of water harvesting rainfall runoff. This technique can have several benefits including decreased water use, and less downslope damage due to erosion. The common method would be to create a series of 6" high water retention berms downhill of each four-tree seedling planting location.

6.0 PLANTING STOCK

All planting stock should be specifically grown for this project by a reputable nursery that specializes in providing plants for restoration or mitigation projects.

6.10 Seed should be from local sources for the *P. torreyana*, and could be collected on the Sub Base if time permits.

6.20 All seed sources should be for selections that emphasize tall growth characteristics, if these are available.

6.30 Because of the demonstrated benefits of mycorrhiaze (Harris, 1983; Shigo, 1986; Marx et. al. 1991), inoculate the growth medium for all seedlings with appropriate mycorrhizal species.

6.31 The nursery should have the demonstrated ability to perform a field inspection of the proposed site to collect and culture mycorrhiaze, if present.

6.32 If mycorrhiaze are not present at the site, the nursery should inoculate the growth medium with appropriate cultures for the individual species of trees being grown.

6.33 The nursery shall have the ability to demonstrate verification of the successful mycorrhizal condition of the seedlings by proper preparation of root samples of selected plants and by providing a series of microscopic slides at the time of delivery of the plants.

6.34 The nursery shall have the ability to interpret the slides to demonstrate successful mycorrhizal colonization.

6.40 The plants shall be grown and delivered in plastic pots that are at least 9.5" deep and have an inside diameter of 2.5". The containers shall have integral internal ribs to direct down any roots that come in contact with the sides of the pot. The pots shall provide for the air-pruning of roots that exit the bottom drain holes.

6.50 Plants shall be healthy and free of all pests and pathogens. Trees shall be sufficiently grown and established in the pots to be successfully field planted in November of 1995, after the first rains.

6.60 Adequate numbers of stock shall be provided for planting and additional stock shall be maintained in the nursery for at least one year for a complete replacement planting, if required.

6.70 The quantity of planting stock required shall be determined by the project biologist.

7.0 PLANTING RECOMMENDATIONS

The following recommendations apply for each four-tree planting site. Proper site preparation has been shown to have many beneficial effects on the establishment and growth of trees (Kozlowski et. al., 1991).

7.01 After the planting sites have been selected, but prior to any site preparations, soil samples shall be taken and a complete fertility analysis shall be performed.

7.02 The laboratory shall be one that specializes in the analysis of soils, particularly for soils that are to be used for the growing of trees.

7.03 Analysis shall include at least the following:
- -texture
- -pH
- -EC or electrical conductivity to measure total salts in the soil
- -Exchangeable Sodium percentage
- -Organic matter percentage
- -C.E.C. or cation exchange capacity
- -Macronutrients: Nitrogen (Nitrate, Ammonium, Urea), Phosphorus, Potassium, Calcium, Sulfur (Sulfate form), and Magnesium
- -Micronutrients: Manganese, Zinc, Boron, Copper, Iron, Molybdenum, and Chloride
- -Lime.

7.04 Soil samples shall be taken from the following locations:
- -3 planting sites at the top of the mesa at 6", 12" and 18" depths
- -3 planting sites on benches or roads at 6",12" and 18" depths
- -3 locations in the existing grove of *E. camaldulensis* at 6", 12" and 18" depths
- -2 locations in the existing grove of *E. cladocalyx* at 6", 12" and 18" depths.

7.05 The the soil sample locations should also be tested to measure the rate of water infiltration. This information is necessary to properly design the irrigation system and will be beneficial to any maintenance personnel involved with irrigating the trees.

7.06 The soil sample locations shall be permanently marked so that additional samples can be taken in the future and comparisons made over time.

7.07 A second set of soil samples shall be taken two weeks prior to planting to verify the effect of the soil preparation and amendment work.

7.08 All the laboratory analysis data shall be interpreted by an arborist skilled in the evaluation of soil analysis data for the purpose of making recommendations for soil amendments or fertilizers that may be used in conjunction with or to supplement the soil amendments specified in 7.50. Particular attention shall be paid to the level and availability of Calcium in the soil because of its contribution to wood strength (McCullough-personal communication).

7.09 Only organic amendments or fertilizers shall be used.

7.10 Clear all existing vegetation, except as may be identified for preservation by the project biologist, down to the soil in an area of 35' by 35'. Do not remove any soil. If vegetation is woody, process through a wood chipper.

7.11 Windrow the vegetation and chips just downhill of the cleared site.

7.20 Rip and cross-rip the site to an 18" minimum depth at 18" on centers. The entire top of the mesa area should be ripped. Project biologist shall identify the extent of the work required.

7.30 Uniformly till or cultivate the soil to a depth of 12" prior to performing 7.40.

7.40 Uniformly incorporate by tilling or cultivating to a depth of 12" a total of 6" of the soil amendment specified in 7.50.

7.50 The soil amendment shall be composed of 80% by volume of composted tree trimming chippings, using only the material that has passed through a 2"x2" screen, and 20% by volume of composted sewage sludge. Thoroughly mix materials together prior to incorporating into soil at the planting sites.

7.51 Install a permanent in-ground irrigation system with a life expectancy of forty years.

7.52 Above-ground irrigation assemblies and all valves shall have a twenty-year minimum life expectancy and shall be designed and installed so that major components can readily be removed and replaced.

7.53 The system shall be a spray system with above-ground heads capable of wetting the entire area of each planting location (approximately 35'x35').

7.54 The water application rate shall be matched to the infiltration rate of the soils.

7.55 The system shall be capable of being adjusted to minimize the spray onto the trunks of the trees after the first year.

7.60 Construct a compacted soil berm centered downslope of each of the proposed tree planting locations. The berm shall be 3' away from the tree at its closest point. At the lowest point away from the tree the berm shall be capable of holding water to a 6" depth. The berm shall be semi-circular in shape. The side extending upslope shall extend 2' above the tree with the opening 8' across.

7.61 Apply a 4" layer of coarse tree trimmings chippings over the entire prepared planting site and over any exposed soil, particularly on the top of the mesa (Downer & Faber, 1994). Apply mulch also on any unpaved access roads that will continued to be used on the site for maintenance purposes.

7.62 Complete the soil preparation a minimum of 60 days prior to planting.

7.63 Apply sufficient water to keep the prepared soil moist to a minimum depth of 12" for at least 60 days prior to planting. Make sure that soil is in a loose, friable and not in a muddy condition prior to planting. Apply a minimum of 12" of water during this 60-day period.

7.64 Maintain berms intact during this 60-day period.

7.70 Rake back mulch 3' away from planting holes. Dig holes that are four times the diameter of the planting pot and 1" shallower than the depth of the root ball.

7.71 Cut any roots that extend past the bottom of the planting pot.

7.72 Carefully remove the seedlings from the planting pots intact and gently tease the soil away from the exterior roots approximately 1/4" without damaging the roots.

7.73 Plant in the center of the prepared hole quickly so that the rootball has a minimal exposure to sunlight and air. This will prevent drying and death of roots. Plant with the top of the rootball 1" above the adjacent soil level (Hagen, 1991).

7.74 Backfill with soil removed from the planting hole, gently firming the soil by hand.

7.75 Immediately construct a temporary 12" diameter watering basin around the tree and apply a minimum of 1 gallon of water. Allow all water to soak in. Wait 30 minutes and apply a second gallon of water.

7.76 Immediately correct any plant or soil settling that occurs as a result of watering. If the plant has to be dug up and raised, repeat 7.75.

7.77 After watering-in has been completed, remove temporary basin and regrade area. Install a 24" high translucent plastic tree shelter. Secure shelter to a 36" long #4 rebar driven into the soil 18" minimum. Push shelter into the soil to a depth of 2". Install a net cover over the opening to prevent birds from getting trapped in the shelter.

7.78 Regrade mulch up to the outside of the shelter.

7.80 Start 90-day establishment maintenance period.

7.90 All soil preparation work, planting and maintenance shall be performed by or under the full time supervision of a Certified Arborist or a Certified Landscape Construction Technician. A Certified Landscape Maintenance Technician may perform work during the 90-day establishment period and all additional maintenance work except pruning.

8.0 MAINTENANCE RECOMMENDATIONS

The success of the planting and mitigation effort is dependent upon the timely and appropriate maintenance that the trees receive after planting is completed.

8.01 The maintenance period will be divided into eight different phases as indicated below:

1) 90-Day Establishment Period
2) 90 Days to 1 year
3) 2 to 5 years
4) 5 to 10 years
5) 10 to 20 years
6) 20 to 30 years
7) 30 to 40 years
8) 40 years plus.

8.02 During each maintenance phase the level of maintenance will decrease slightly as the trees become more established. Some level of maintenance will be required in perpetuity to assure the viability of the site as a heron rookery.

8.03 The trees shall be evaluated every 6 months and the weakest tree shall be removed until only one of the four planted trees at each planting site remains. If one or more trees have died no removal will take place that would exceed the rate of one removal per 6 months. This evaluation shall be performed by a Certified Arborist.

8.04 If all trees at a planting site die, replant all four trees and start over with Specification 8.03.

8.05 Identify all trees with a permanent identification number.

8.06 At the end of the first year after planting, and every year thereafter, until forty years has passed or active nesting has commenced, evaluate each standing tree recording its height, caliper and condition utilizing the methodology of the International Society of Arboriculture contained in the "Guide for Plant Appraisal" Eighth Edition, 1992, or use later revised versions of this publication as they become available. This review shall be performed by a Certified Arborist.

8.07 Chart the growth data annually for each tree to determine if additional fertility analysis or treatment maybe warranted on an individual or group basis.

8.08 Remove the tree shelters and rebar stakes after the first year. Provide wire cages made from 1/4" mesh galvanized screen that are 3' high and 3' in diameter. Install 3" deep in the soil to protect against rabbits, squirrels, and mice. Use rebar for additional support of the cage if required.

8.09 Do not stake trees. If trees will not remain upright after the removal of the tree shelters, prune as required to remove weight and thin the top of the tree, until it can remain upright without support.

8.10 Observation and watering schedule with percentage of weekly or monthly Evapotranspiration Rate (ETo) of water to be applied:

Maintenance Phase	Frequency	% ETo
1) 90-Day Establishment Period		
First 30 days	3 times per week	100
Second 30 days	2 times per week	100
Third 30 days	2 times per week	100
2) 90 Days to 1 year	1 time per week	75
3) 2 to 5 years	1 time per week	50
4) 5 to 10 years	biweekly	50
5) 10 to 20 years	biweekly	40
6) 20 to 30 years	monthly	30
7) 30 to 40 years	monthly	25
8) 40 years plus	monthly	25

8.11 This is the minimum observation frequency acceptable. Site conditions may warrant more frequent observations and maintenance as required.

8.12 Maintenance includes rebuilding of berms, weeding, pruning and observations of any pest problems followed by appropriate action, as well as periodic observations of the irrigation system with adjustment and repairs as required.

8.13 Frequency of water application will also be determined by the limits and ability of the irrigation system installed. A more complete discussion will be found in "Landscape Irrigation System Evaluation and Scheduling for Southern California" (Shaw & Zellman, 1992).

8.14 The intention is to provide sufficient levels of moisture to sustain initial rapid growth. As the plants mature, slowly decrease the amount of water to levels that will adequately sustain growth (B. Perry, 1992).

8.15 For optimum performance the trees should be irrigated regularly at least until they reach the required height for nesting. The application of irrigation water will require proper management.

8.16 Overwatering, if it occurs even briefly, can produce anoxia and root death (Perry in Watson, 1993). Prolonged or repeated overwatering can have a severe negative effect on the trees and lead to early decline and make the trees more susceptible to disease infestations. This can lead to premature tree failure.

8.17 A semi-automatic irrigation system is preferred, so that the required human monitoring takes place. This monitoring includes observation, evaluation and decision making of when to water and how much water to apply. The decisions are based on the soil, the condition of the trees, and the current or projected weather. A fully automatic system is often set and forgotten, unless severe problems start to show up.

8.18 The time of the year that the water is applied may be more critical than the overall quantity of water applied. Winter and spring applications, particularly in a dry year, may be more beneficial than water applied as a uniform percentage of ETo. Less frequent applications in the summer, as long as adequate soil moisture is

maintained, would be acceptable. Additional research on water utilization in ring-porous and diffuse-porous trees may more fully substantiate this recommendation.

8.19 After adequate watering, soil fertility is the next critical limiting factor.

8.20 Fertility management will require periodic soil testing and the renewal of mulch as it decomposes. Perform soil testing and analysis according to the following schedule:

Maintenance Phase	Frequency
1) 90-Day Establishment Period	not required
2) 90 Days to 1 year	yearly
3) 2 to 5 years	yearly
4) 5 to 10 years	every other year
5) 10 to 20 years	every other year
6) 20 to 30 years	every 5 years
7) 30 to 40 years	every 5 years
8) 40 years plus.	every 5 years

8.21 Soil tests should occur at the same time every year, taken at the previously marked locations.

8.22 Tests can be recommended more frequently if particular problems have been identified and specific remedies have been undertaken to correct the problems.

8.23 Additional mulch should be applied every six months, or at least annually based on the rate of decomposition.

8.24 Mulch shall be the same as specified in 7.61. Chipped tree prunings from the Sub Base can be used, which would divert a valuable resource from the waste stream and save disposal costs at the same time. Fresh eucalyptus tree mulch has been shown to be as good as composted material (Downer & Faber, 1994).

8.25 Maximum thickness of mulch should be 3-4".

8.26 The mulch may reduce the amount and frequency of water specified to sustain good growth rates.

8.27 Mulching the top of the mesa and the unpaved roads can decrease the erosion and runoff problems on the site while allowing for greater water infiltration.

8.30 Structural pruning shall only be performed by a Certified Arborist, or by a Certified Tree Worker under the direct full time supervision of a Certified Arborist.

8.31 All pruning shall be performed in accordance with the "Pruning Standards" of the Western Chapter of the International Society of Arboriculture adopted in 1988.

8.32 Pruning shall only be done to achieve stated definable goals. All pruning shall be followed by a written evaluation of the results obtained and compared to the defined goals. This evaluation shall occur 12 months following the pruning.

8.33 In order to achieve the best overall growth no foliage shall be removed without a specified reason (a defined goal). Some practices such as shortening the lower lateral branches on the eucalyptus to achieve greater height can be tested by performing the practice on 25% of the trees and comparing the results to the growth of the control trees.

8.34 Correct potential major structural defects, such as co-dominant trunks, as soon as possible.

8.35 Evaluate the need to prune the trees on an annual basis for the first 5 years, every 2 years for next ten years, every 3 years for the next fifteen years and then every 5 years until nesting height and suitable nesting branch forks are established.

8.36 The project biologist shall be consulted and direct the work in establishing suitable nesting forks in the trees.

8.37 Dead branches in the trees and on the ground that are suitable for nest building should not be removed or chipped.

8.38 If trees die after they have attained nesting height, they should be left standing for nesting sites.

8.39 Pruning shall only be performed after all nesting activities are completed. The project biologist shall advise those performing pruning work when the most suitable time(s) of the year for pruning occur.

8.40 Pest problems, if they arise, should be controlled by the use of I.P.M. (Integrated Pest Management) techniques. The use of sprays, injections, or drenches that contain any chemicals that may have an adverse affect on any of the birds or their habitat shall be prohibited. No chemical applications will occur without the written approval of the project biologist.

8.41 All work in pest control shall be under the written directions of a licensed Pest Control Advisor. Unless not specifically required, all work for pest control shall be performed by a licensed Pest Control Applicator.

8.42 No spraying for vegetation control will be permitted. No vegetation removal will be performed without the approval and direction of the project biologist.

8.50 As part of the Arborist's annual evaluation and review, additional recommendations or revisions may be submitted for approval by the project biologist prior to implementation. All recommendations and revisions whether approved or not will become part of the project file that is to be retained for use in the future.

9.0 EXISTING TREE RECOMMENDATIONS

9.10 The existing trees identified as *E. camalulensis* located in a grove adjacent to Steam Plant Parking Lot #2 should be keyed out and positively identified by an individual skilled in the identification of eucalyptus trees.

9.20 Only if the trees are of a species that will reach a mature height and structure suitable for nest establishment should the following procedures be followed.

9.30 The existing grove shall be thinned 30-50%, removing trees that are dead, dying or diseased, and then any smaller or weaker trees that are crowding larger healthier specimens.

9.31 Thinning of tree stands reduces competition and postpones reduction in growth rate both of which are characteristic of aging stands (Kozlowski et.al., 1991).

9.32 Chip all removed trees and branches and spread chips on site under the remaining trees.

9.40 Remove trees or branches that at maturity may overhang the parking lot.

9.50 Install an irrigation system (as previously described for new tree plantings) capable of applying water uniformly over at least 75% of the grove.

9.60 Based on the results of the soil analysis, make ground surface or foliar applications to correct any identified deficiencies or chemical imbalances detrimental to tree growth.

9.61 Environmental stress is the major limiting factor to growth. .Growth is the integrated response to numerous continuous and periodic stresses (Kozlowski et. al., 1991).

9.62 Check for the presence of mycorrhizae in the grove and on the roots of the existing trees. Add mycorrhizae inoculum to the soil if recommended based on field survey results.

9.70 Build check dams and use other "water harvesting" techniques that may be applicable in individual situations.

9.71 Apply 3" of mulch as for new plantings. Mix 15% by volume of composted sewage and 15% by volume composted tree pruning chippings with mulch before spreading on the site.

9.80 Begin a maintenance program as outlined for new plantings. Assume that this grove is at "year one" in the maintenance schedule.

9.90 Identify trees and monitor progress.

9.91 At 10 and 20 years determine if trees are making sufficient progress to warrant continued effort or if trees should be removed and 50% of the site planted in new trees.

10.0 ADDITIONAL RECOMMENDATIONS

10.01 In the grove of existing *E. cladocalyx* provide for watering and maintenance as shown on the schedule for trees at 40 years plus.

10.02 Based on the results of the soil analysis make ground surface or foliar applications to correct any identified deficiencies or chemical imbalances detrimental to tree growth. **NOTE:** No foliar applications are to be made in any trees with nesting activity.

10.03 Apply mulch to existing leaf litter to obtain a total depth of 3-4".

10.04 Test soil annually under trees with and without nesting activity to determine if changes in soil chemistry are occurring that may warrant additional research or maintenance.

10.05 Additional research may include soil testing in and adjacent to the dead and dying and healthy trees at the Morro Bay rookery to determine if any significant differences in soil chemistry exist.

10.10 The grove of *E. sideroxylon* located on top of the mesa can be considered for removal in whole or in part for additional planting sites, especially if there are locations with good orientation for nesting trees.

10.20 Additional trees should be planted, if they do not colonize the area, every 30-40 years, especially if it appears that the bird excrement that accumulates is having a detrimental effect on the trees and their longevity.

10.30 A long term rotational planting may be required along with soil modification, composting and cleanup if the site is to be maintained as a rookery in perpetuity.

10.40 Growth stimulants could be tested that could prove to have significant long term benefits that would be useful on other difficult sites on the Base and elsewhere.

10.41 "ROOTs" T.M. is a product formulated to enhance root growth and development and could be tested on a portion of all the seedlings or a portion of the sites. It may also be beneficial for use on the existing *E. camaldulensis* grove.

10.42 "Sonic Bloom" is a process using recorded sound to stimulate the opening of stomata on the leaves coupled with a formulated foliar spray. The larger stomatal opening is reported to enhance the uptake of the foliar applied nutrients and results in larger leaf size, greater leaf numbers and increased canopy size which results in faster growth and healthier trees.

10.50 Because of the long term nature of this project and the ability to provide long term care and monitoring, this could be an excellent chance to provide research opportunities for Masters and Doctoral studies. The benefit to the project would be a closer monitoring of the progress and development of the trees, while at the same time evaluating products and processes for both their short-term effects and their long-term benefits.

10.51 The collected data can be used to repeat any successes discovered or to discard any products or techniques that prove not to be effective. This could prove to be a significant benefit to the arboricultural community worldwide.

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PHOTOGRAPHS

WISNIEWSKI & ASSOCIATES
ENCINITAS, CALIFORNIA

Figure 1. View of site showing existing *E. cladocalyx*, slope, road, mesa, and cable tower.

Figure 2. Holes in soil near *E. sideroxylon* on top of the mesa.

Figure 3. Existing *E. cladocalyx* without nests. Note the slope erosion in the background and the piles of soil dumped in the right foreground.

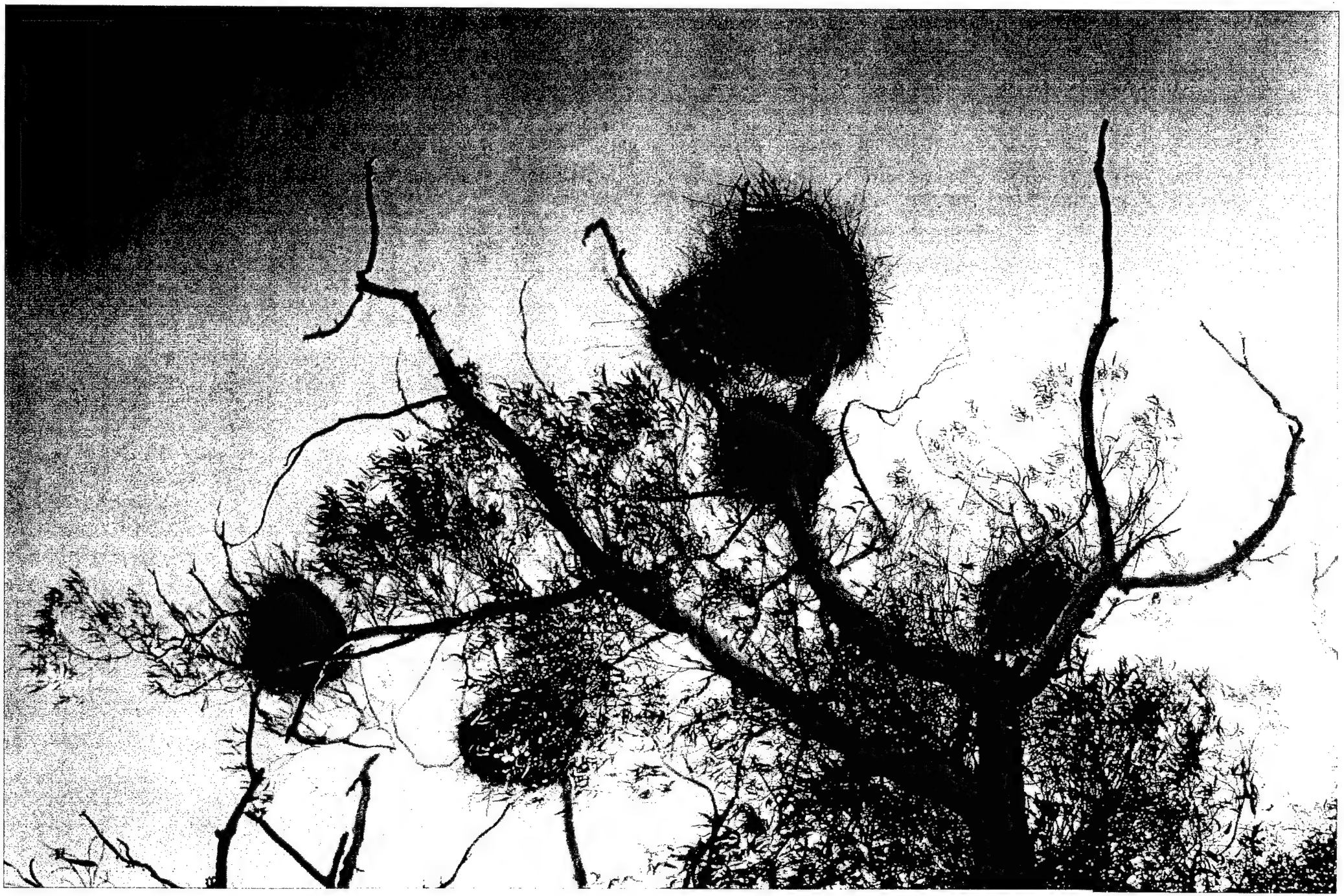


Figure 4. Great Blue Heron nests in *E. cladocalyx* .

Figure 5. Grove of overcrowded *E. camaldulensis* near Steam Plant Parking Lot #2.

ATTACHMENTS

WISNIEWSKI & ASSOCIATES
ENCINITAS, CALIFORNIA

SAN DIEGO
PEOPLE for TREES
SPRING 1993

SECOND ANNUAL ARBOR DAY TREE WALK

On May 1st from 9:00 - 11:30 am, PFT will guide San Diegans on the "TREE WALK OF MISSION HILLS." The walk will begin at the Francis Parker Lower School, at 4201 Randolph, S.D. The school is co-sponsoring the event. Refreshments will be served and a $5.00 donation is requested. Tours leave every 30 minutes. Folks have been asking us since our last successful tour of Middletown, **when** we would be doing it again? Come celebrate with us honoring these most noble of creatures.

SUPERVISOR'S TRAINING PROGRAM

On February 6th, between rain storms, 20 tree planters, some old hands and some new volunteers, met at the San Dieguito River Park for a session on "Planting Techniques" and "How to be a Planting Event Supervisor or Crew Leader."

New techniques and ideas were presented for planting in natural habitat areas such as the Oak/Grassland restoration site near Lake Hodges.

The planting techniques include clearing 6' minimum planting areas of grasses and annuals, building large semi-circular berms on the downhill side of the planting area to "harvest rain run off water," "inoculating" the planting backfill soil with a bucket of soil from an existing oak grove and mulching with 1" - 2" of oak-leaf mold which was also gathered from an existing oak stand. *(Continued P. 7.)*

DID YOU KNOW . . .

That one large tree has the same cooling effect as 15 room size air conditioners? Mature trees shading homes cut energy bills fro 18 to 50 percent.

That *The 1993 Information Please Environmental Almanac* (Houghton-Mifflin) ranks San Diego #2 for environmental quality of metro areas with populations of 500,000 or more? The rating is based on air and water quality, transportation practices, toxic chemical emissions and energy use and price. Honolulu was #1.

That free mulch and loading are available at the San Marcos (1595 Questhaven) and Sycamore (14494 Mast Blvd.) Landfills? Pick up a loading slip at the fee booth and bring a tarp to secure your mulch. Self loading is available during all landfill hours. Mulch is good for water conservation, ground water, soil enrichment and erosion and weed control. Hours: Monday - Friday 7:00 am - 4:30 am, Saturday and Sunday, 7:30 am t 4:00 pm.

The California Association of Nurseryman has published a horticultural K-6 curriculum called *Planting Seeds, Growing Minds?*. This curriculum is chocked-full of valuable information and projects, featuring eleven different lesson plans, you can do with your students or with kids at home. Prices range depending on the number of copies from $3.00 to $5.00. Call 916-567-0200 for more information.

That trees increase property values? Trees can add up to 20 percent to the value of a home. However, without proper maintenance the value of trees decline.

That Nike Inc. is planning to introduce sneakers made of recycled materials? The first shoes will be available in the spring selling for approx. $75 in boxes made from recycled paper. By fall, Nike hopes to offer seven styles of outdoor sports shoes. Eventually, recycled materials will be used in basketball, aerobic, and running shoes. *(New York Times)*

Gasoline powered lawnmowers are coming under increasing scrutiny because of their contribution to air pollution? Electric mowers are a possibility, but have many drawbacks. How about the good ol' push rotary mowers many of us knew as very young kids? Clean air, good mulch and good exercise too!

That some researchers believe that as many as one out of every ten plants contains compounds with ingredients that could be used to actively treat cancer? Yet a recent survey of botanists indicates that in the next five years more than 250 plant species in the United States alone face "a real risk of extinction." Those 250 represent a tiny fraction of the number of species that will become extinct worldwide in the same period of time. *(National Wildlife)*

"These trees shall be my books."
William Shakespeare

WATERING TREES by: Mark Wisniewski

A question I am asked frequently is, "How often do trees need to be watered?" The correct answer is, "Whenever they need to be watered." This usually proves to be an unsatisfactory answer to most people.

If you were to ask them, "How often do you put gas in your car?" they would tell you, "It depends on much gas I have in the tank and how far I'm going and how fast I drive to get there." This is also similar to the answer on watering trees.

Before a more detailed answer can be provided about watering a lot more information is required about the tree. Such as the following:

•What species is it? Some trees have higher water requirements such as Alders and Willows than do Torrey Pines or Coast Live Oaks. Fruit trees usually require more water than most ornamental trees.

•When was it planted? Newly planted trees regardless of species require more frequent watering than trees that have been in the ground for several years. Many drought tolerant trees, if they have had careful watering (not too much or too little) during the first three to four years after planting may not require additional watering to survive once they are established. In trying to establish a drought tolerant tree you will need to decrease the frequency of watering over time.

When we plant seedling pines and fir trees in the Cleveland National Forest we plant in the spring when the ground moisture is high. The trees receive no supplement watering and we have survival rates of 80% and higher after one year.

•How big was the tree when it was planted? Seedlings or one gallon size trees may need to be watered every 2-3 days right after they have been planted. A 15 gallon tree may do just fine if it gets watered once a week for the first two months after it is planted. The larger a tree is at the time of planting or transplanting, the longer it will take to get the tree established on its own.

•What time of year was it planted? What time of year are you asking about watering? PFT tries to do the majority of its community plantings in the winter to take advantage of winter rains. In Leucadia along Highway 101 we have planted 15 gallon trees in January and December the last two years. After the watering at the time of planting **no** supplement water was applied until after mid April and then only every other week till the rains started the first year and once per month the second year. First year survival exceeded 90% and only 2 or 3 of the tree losses could be attributed to insufficient watering.

Trees will need more water in the summer as day length and temperatures increase than they will in the fall or winter. This is due to an increased evapotranspiration rate. Evapotranspiration is the amount of water that is lost due to evaporation and transpiration from the leaves. This can be less than 1/2" a week in the winter and over 2" per week in the summer.

-What is the soil type? This is one of the greatest variables in determining water need and usually the least understood. A sandy soil is granular to the touch. The individual soil particles can be seen with naked eye and when wet it can be formed into a ball, that will crumble easily. It will not form a ribbon when pressed between the thumb and forefinger.

A clay soil is so fine when dry that the individual particles can not be seen, but appear as fine dust. When it is wet it can be formed into a ball that will not crumble, and it can be pressed into a ribbon 1"-2" or longer. Loam is another soil type intermediate between sand and clay. OK, so what?

Well knowing the soil type tells you a lot about how to water, how much to water and how frequently to water. Sand being granular has a very open soil structure, therefore water penetrates it readily and deeply with little effort. However, since it drains readily it dries out quickly and needs to be watered more frequently than clay soils.

Clay soils are tightly packed flat particles. Water has to be applied slowly otherwise it will just runoff and not penetrate very deep at at all. Once the soil is wet, however it holds onto the water because of the very small pores and makes water available to the plants as the soil slowly dries out.

•Where is the tree planted? A tree planted on the north side of a two story house will need to be watered less than one planted on a sunny south or west exposure. A tree planted where it is exposed to ocean breezes will require more frequent watering than one planted below the top of a hill that protects the tree from the wind.

•Is there a mulch layer around the tree? How deep is the mulch? How far out from the tree does it extend? Mulch helps conserve water by preventing water loss from the surface due to evaporation. (See PFT Winter Newsletter for additional info.) A 2"-4" layer of organic mulch will stretch the time between watering considerably.

•What is planted around the tree? Trees planted in a lawn still need regular soaking since the lawn is usually shallow rooted (6" or less), but is very competitive in utilizing the water in the top 6"of soil. Lawn watering usually does not provide water down deep enough for trees. Remember the root ball of a 15 gallon tree is about 16" deep.

•When do you need to water? When the top 6" of soil is dry and crumbly. This is best judged by using a soil probe to remove a core of soil down to the 12" level at least. A shovel can also be used, but this will damage some roots as well, especially if you do this frequently. A long blade screwdriver can be used but does not remove a sample like the soil probe does.

•How much do you need to water? Enough to wet the entire root zone down to a minimum of 18"-24". On newly planted trees with a 6" high by 4' wide basin, fill the basin completely, let the water soak into the soil and fill the basin again. This will take from 15-30 gallons at each watering. Note that a typical toilet flush is 5-7 gallons and letting the water run while you brush your teeth may waste up to 3 gallons.

(*Continued* next page)

PARK AND RIDE AND SHADE

By: Curt Lutz

In cooperation with CalTrans through a grant they made available to promote an adopt-a-*Park and Ride* project, People for Trees was able to help plant dozens of trees at several *Park and Ride* lots throughout the county. The project was completed in April with the diligent oversight and efforts of CalTrans Landscape Architect and **People for Trees** member Larry Fagot.

This project was a true test of overcoming the adversity of digging in hard soil and digging through administrative red tape. But persistence, volunteers, and **People for Trees** prevailed. Thanks to all of the **People for Trees** members and volunteers who pitched in over those weekends.

With the completion of this project the environment will benefit two-fold: First - trees are growing and providing cooling shade to those asphalt landscapes and providing oxygen and filtering pollution in the midst of auto traffic. Second - Trees will make *Park and Ride* lots more attractive, but the real beauty of *Park and Rides* is that they give commuters the opportunity to reduce air pollution and traffic congestion by sharing a ride to work in carpools and vanpools. If you would like more information on how to Rideshare call 237-POOL.

• • •

WATERING Con't from p. 4.

You can also capture the warm up water in the shower or bath (approximately 2-3 gallons) in a bucket and use this on your trees or garden. One of our volunteers in his 70's uses this technique to water the trees in an **unirrigated** median in the street in front of his house on Del Cerro Blvd. After two years this planting of over 60 trees has 100% survival. The other trees in this planting are watered by neighbors and the community coordinators using hoses, and are only watered when the trees need it.

What is the weather like? Did it rain in the last week, and did the rain soak into the ground? If it is cool and overcast you can go longer between waterings than if it is hot and dry. If a Santa Ana wind is coming up, water before, if possible and again after the Santa Ana winds are over.

So the answer to the question is - to water when the tree needs to be watered, and this will be different for every location.

These are a lot of variables to consider and people like set schedules. This usually does not work well over the long run because of all the differences we have just discussed. I will **reluctantly** offer a **general guide**.

Water newly planted trees one time per week for the first two months. Then water once every two weeks until the rainy season starts. If it rains less than 1/2" per week, continue to water every two weeks. The second year water once per month. The third water every six weeks or as required by the condition of the trees. Keep 2" of mulch in place up to the drip line of the tree. After the first year water up to 2'-4' of the dripline and fill the basin twice at least.

Watch your trees and feel the soil and you will soon learn to know when to water, just **before** your trees are showing signs of stress. If you can learn when to fill your gas tank **before** you run out of gas you can learn to water trees **before** they run out of water.

SPECIAL THANKS TO MACLAB,
In Encinitas,
and Richard & Victoria Pizzoferrato
for their generous donation of computer lab time and technical assistance, on a regular basis, towards the creation of this newsletter!

LOGAN HEIGHTS FAMILY HEALTH CENTER

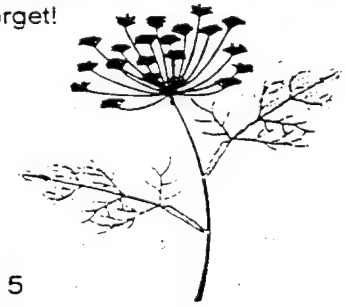
by: Mark Wisniewski

At 8:00 A.M. on Saturday - June 12th, **PFT** volunteers and the staff and friends of the **Logan Heights Family Health Center** will gather at the 1809 National Avenue location in San Diego to install the next phase of the landscaping in the courtyard of the soon to be completed expansion to the Center. The grand opening of this new addition is set for noon on June 18th, but this is the only day when the landscaping work can be completed.

This will be our second project with our good friends at the Center since our initial effort on Cinco de Mayo in 1991. Like our first project this one will feature colorful and drought tolerant trees and shrubs. The first plantings are now well established and grace the site with a parade of blooms while providing shade and screening at the same time.

Our supporters at **GEO** have again generously donated **$500** towards defraying the cost of the planting material for this project. Additional contributions are always welcome for this vital community clinic.

This will be an all day event - till the last plant is in the ground, watered, and the site is cleaned up. The Center will provide one of its famous tamale lunches for all the workers. It is worth it just for the lunch, but the real fun is getting to work with this dedicated staff of doctors, nurses, and administrators. These are folks who really know how to roll up their sleeves and get to work. The wouldn't have constructed this impressive three story addition to their expanding facility through community donations without boundless energy and optimism. They have a critical job to do and they do it extremely well. If you want to meet some really great folks come out and join the fun. It will be a day you won't forget!



SAN DIEGO
PEOPLE for TREES
SUMMER 1993 VOL. IV; NO. II

CLEVELAND FOREST INITIATIVE MOVES TO NOV. 2 VOTE

By: Duncan FcFedridge

Good news on top of good news! On May 7 Judge Judith Haller issued an order declaring a moratorium on the Cleveland Mountain Region of the Cleveland National Forest until the County prepares a new and valid Environmental impact report. The inadequacies were of such a degree that the decision making during the plan update was fundamentally "compromised."

Judge Haller's decision gives additional strength to the rationale behind the Forest Conservation Initiative which will now appear on the November 2nd ballot because of the special election called by Governor Wilson.

Now is the time. Here is the place. We have qualified the Initiative. We have won a tremendous legal victory. We must follow through with a victory at the polls in November. Campaigns, as you know, need volunteers and money. Please call 445-9638 to see how you can get involved.

Remember November. It's YOUR forest. YOUR vote can SAVE it!

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Take Me To Your Leader

By: Curt Lutz

Well what do you know, the rest of the world is discovering what we at **People for Trees** have known for a long time, that Mark Wisniewski (past president and current vice president *and* Project Coordinator) is a great leader.

KGTV Channel 10 selected Mark for the **10 Leadership Award** last month. You may have seen him on TV receiving his award in the presentation piece run throughout the month. Channel 10 discovered Mark's abilities when People for Trees worked with the TEAM 10 volunteer project to plant over a hundred trees in Normal Heights last year.

Mark was recognized for leadership, but we at People for Trees recognize that Mark has many other attributes as well, including expertise as a Landscape Architect, a Certified Arborist, a Licensed Landscape Contractor and talents in making people feel important and appreciated. Hey, maybe those are some of the reasons Channel 10 thought Mark deserved a Leadership Award! Well we sure agree. Congratulations and thanks for everything Mark!

"Everybody can be great, because anybody can serve."
Dr. Martin Luther King

NEWSLETTER

PRUNING YOUNG TREES

By: Alden Pedersen

Pruning of newly planted or very young trees should be done sparingly. Only broken branches and dead limbs should be removed. Corrective pruning should be done after a full season of growth in the ground. Pruning should then include the removal of water sprouts, crossing and interfering limbs and limbs which are growing at poor angles - especially those outside the natural canopy. Low limbs should not be removed for several years since those are the limbs which primarily contribute to trunk girth development. When pruning, Try to visualize the result of the cuts before the cuts are made.

On more mature trees, pruning should be done regularly to control a tree's shape and to keep branches from harming surrounding structures or people. For most trees, the best time to prune is winter to early spring. Trees pruned at this time of year close their wounds more quickly. Exceptions to this are trees that have problems with disease in the spring. Oaks and birch are examples of trees which are susceptible to disease if pruned during rainy weather.

Pruning should always be performed sparingly; over pruning is extremely harmful because without enough leaves, a tree cannot gather and process enough sunlight to survive.

The recommended method of pruning, developed over the past decade, is called **natural target pruning.** It is natural because the cuts are made along lines that the tree forms to aid in natural branch shedding. It is called target pruning because the tree provides target guides for the cut.

The first target is the outer side of the **branch bark ridge** where the branch meets the stem. The second target is the junction of the lower part of the branch and the main stem called the **branch collar.**

Every branch has internal tissues that separate it from the trunk. These tissues are instrumental in the process of wound closure and self-defense must be protected and maintained during pruning. As this internal branch tissue forms, the bark is forced upward to form a raised ridge on the trunk that separates the branch from the trunk. This raised area is the bark ridge (Figure 3).

The branch collar is slightly swollen area where the branch attaches to the trunk (figure 3). It is most prominent on younger branches and branches that are dead or dying.

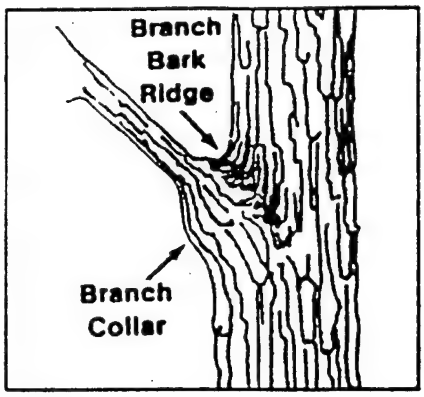


Figure 3.

Proper pruning means removing the branch so that the branch collar is not injured or removed. No cuts should start behind the bark branch ridge. The cut usually ends up be-ing perpendicular to the axis of the branch being removed (Figure 4).

When removing dead branches, never cut into the callus tissue which has formed at the base of the branch. Remove the branch beyond the callus ridge so that no living material is severed or detached (Figure 5).

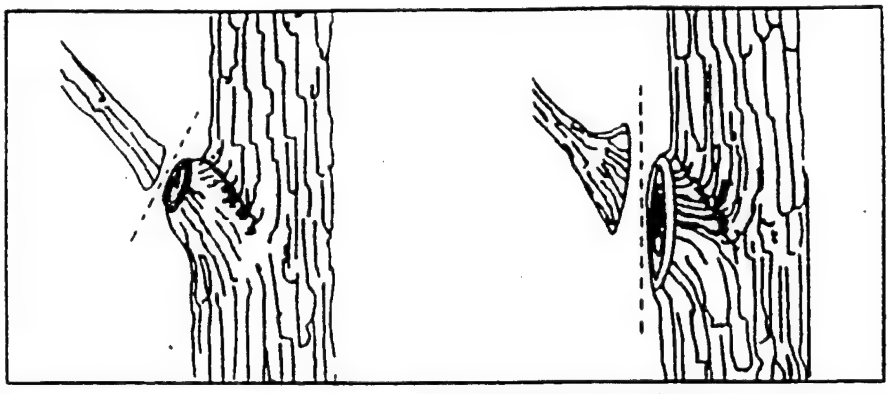


Figure 4.
Live branch removal.

THREE-STEP METHOD

To remove large branches (over 1" diameter) use the three-step cutting method (Figure 6). This removes the weight of the limb before the final cut and eliminates the possibility of stripping the bark down the side of the main trunk.

WOUND PAINTING

Research conducted in the past several years indicates that a wound dressings (creosote, tree paint, tar) **do not** prevent decay and that they are of limited value for wound closure. In fact, applying a dressing to exposed wood (caused by breakage or a pruning cut) only seals in disease microorganisms and creates a perfect habitat for advancing decay.

When a tree is wounded, the injured tissue is not repaired and does not heal. **Trees don't heal; they seal.** They have a unique defense system called **compartmentalization** that sets up a protective boundary between injured and healthy tissues. This area is highly protective and physically and biochemically resists the spread of infecting organisms. The most important thing you can do to enhance this natural process is to prune wisely and carefully and keep your trees vigorous and healthy.

REVIEW OF NATURAL TARGET PRUNING

1. Locate the branch bark ridge (BBR)
2. Find target A - outside BBR
3. Find target B - where branch meets collar.
4. If B cannot be found, drop an imaginary line at AX. Angle XAC equals XAB. *(Continued p.8.)*

PRUNING Con't from p..3

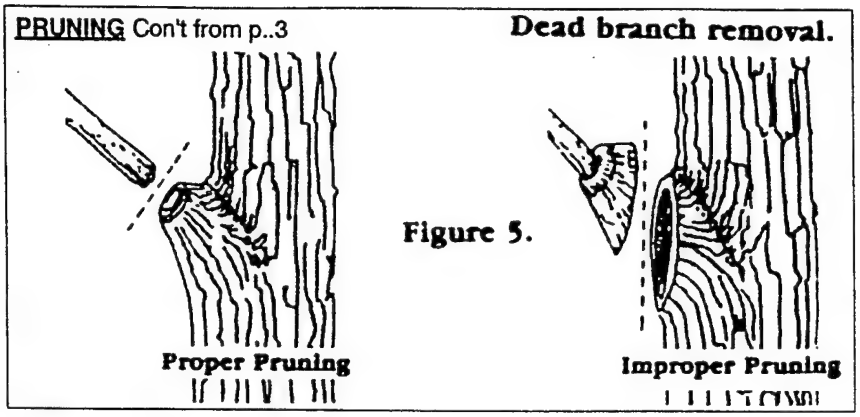


Figure 5.

5. Stub cut the branch.
6. Make final cut at line AB (with chainsaws ,make final cut on upstroke)

Do not:
- make flush cuts behind the BBR
- living or dead stubs
- injure or remove the branch collar
- paint cuts.

TOPPING IS TABOO !!!

Topping, also know as hatracking, stubbing, or dehorning, is the practice of removing major portions of a large tree's crown by cutting branches to stubs and or/to the trunk (figure 7a). Topping severely injures and infects trees, sometimes killing them outright. It drastically reduces food-production capacity, destroys natural growth habits and creates large wounds and encourages growth of disease.

Regrowth after topping is vigorous and upright from the stubs (Figure 7b). The new branches form a compact head of broom-like terminals, often weakly attached. After a few years topped trees become a safety hazard to people and property. The weakly attached sprouts at the ends of remaining stubs are easily broken in high winds.

Trees should never be topped for any reason! Better treatments are always available. If your objective is to reduce or otherwise control the growth pattern of a tree, there are other accepted methods you can use such as drop-crotch pruning or directional pruning. When in doubt, please consult a certified arborist.

(Alden Pedersen is the current President of the Professional Tree Care Association)

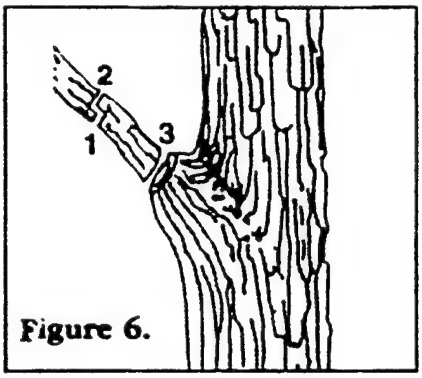
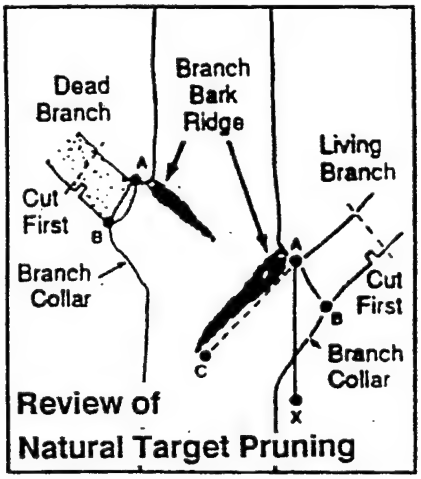


Figure 6.

1. Undercut to prevent limb breakage.
2. Cut down and remove limb.
3. Trim branch stub at branch collar.



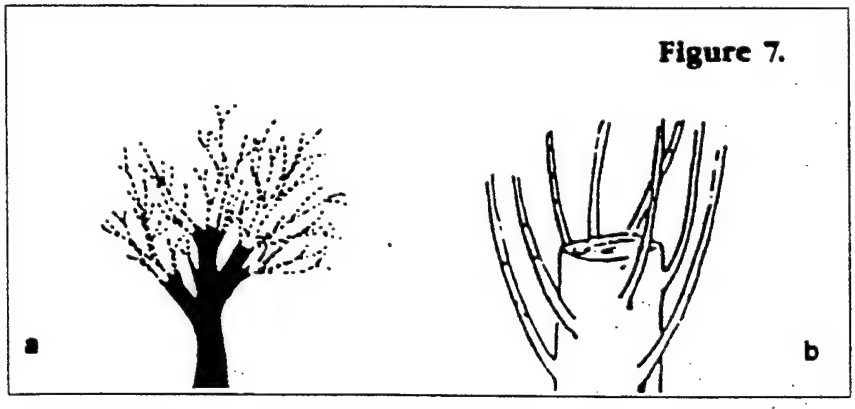


Figure 7.

The San Diego Auto Show is scheduled for March 17th through the 21st, 1993, at the San Diego Convention Center. People for Trees will be participating there to help support the **GEO** Family of Automobiles. The **GEO** Metro, Storm, Tracker and Prizm will be on display. The **GEO** Metro is the most fuel efficient car in America for its estimated 53 miles per gallon city / 58 mpg highway performance.

GEO supports dozens of local, non-profit tree planting organizations in communities like ours and continues to sponsor many other environmental events as well.

The **GEO** Tree Program, a grassroots undertaking, is responsible for educating tens of thousands of concerned citizens about the environmental benefits of planting trees and by encouraging them to become active on a local level.

JUNK MAIL Con't from p.8

- Metromail Corp., List Maintenance, 901 W.Bond, Lincoln, NE 68521
- Database America, Comp. Dept., 100 Paragon Dr., Montvale, NJ 07645-0419.
- Dunn & Bradstreet, Customer Svc., 899 Eaton Ave., Bethleham, PA 18025.

For more Information join the **Stop Junk Mail Association** and receive a mail-reduction kit. Write: 3020 Bridgeway #150, Sausalito, CA 94965 (800) 827-5549.

Appendix G-Plant List for Restoration and Revegetation

Suggested native plant list for revegetation or ecological habitat restoration, with names from Munz and from Beauchamp (A flora of San Diego County, California). They have not been checked with the new Jepson Manual; the "+" on the right means essential; some notes are included with the scientific name:

	Common Name	Scientific Name	Lbs/ A
+	Deerweed	*Lotus scoparius*	3
+	Flat Top Buckwheat	*Eriogonum fasiculatum ssp. fasiculatum* (be careful to get THIS ssp.)	1.5
+	California sagebrush	*Artemisia californica*	1
+	Golden Yarrow	*Eriophyllum confertiflorum var confertiflorum* (low per.shrub; long blooming, bright yellow)	1.5
+	Black Sage	*Salvia mellifera*	2
+	Coast Sunflower	*Encelia californica* (drought deciduous)	.5
	Monkey flower	*Mimulus puniceus* (needs more moisture; beautiful red flowers, green leaves; drought deciduous)	.05
+	Golden Bush	*Happlopapus venetus*	.2
+		*Euphorbia misera* (common on these slopes; attractive w & w/o leaves)	2
+	Foothill Bunch Grass	*Stipa lepida* (both grasses plentiful on similar slopes)	2
+	Bent Grass	*Agrostis diegensis*	2
+	Common Rock Rose	*Helianthemum scoparium var. vulgare*	2
	Corethrogyne	*Corethrogyne filaginifolia var. virgata* (lavend.fl)	1
+	Felt Paintbrush	*Castilleja foliolosa* (red/orange bloom)	1
+	Toyon	*Heteromeles arbutifolia* (tallest "tree", needs more moisture; occurs in canyon bottoms & sides)	1
+	Mission Manzanita	*Xylococcus bicolor*	1

+	Warty-stem Ceanothus	*Ceanothus verrucosus*	1
	Scrub Oak	*Quercus dumosa* (very nice and dense)	1
	Purple Nightshade	*Solanum xantii* (will prob. volunteer in)	.5
	California Poppy	*Eschscholzia californica* (great for quick 1 yr color; may or may not last)	2
+	Sun Cups	*Camissonia bistorta* (common yellow annual)	1
	Nuttles Snapdragon	*Antirrhinum nuttallianum* (small purple flowers on stalks; common & pretty; annual)	1
	Gnaphalium	*Gnaphalium bicolor* (attractive, common)	1
+	Mariposa Lily, yellow	*Calochortus weedii var. weedii* (spectacular)	.5
+	Blue Dicks	*Dichelostemma pulchella*	.5
+	Star Lily	*Zigadenus fremontii*	.5
+	Wild Onion	*Allium praecox*	1
+	Soap Root	*Chlorgalum parvaflorum* (grows well under Eucalyptus; see under black-crowned night heron nesting trees on slope)	.5
+	Box Thorn	*Lycium californicum* (huge thicket on NW side of Area 3; evergreen)	1

Ecesis

Ecesis \i'se-sus, i-'ke-sus\ noun [from Greek oikesis meaning inhabitation]: the establishment of an animal or plant in a new habitat

THE QUARTERLY NEWSLETTER OF THE SOCIETY FOR ECOLOGICAL RESTORATION, CALIFORNIA CHAPTER

VOLUME 2, ISSUE 2 **SPRING 1992**

The following specification, taken from a project performed for Caltrans in the Tierra Santa area of San Diego , was originally written by John Rieger's staff at Caltrans. This specification is the result of experiences with three previous projects. This is the first in a semi-regular series of articles

TRANSPLANT BARREL CACTI — Approximately (number) existing barrel cacti shall be transplanted to the (specific location).

Cacti to be transplanted shall be transplanted before any required clearing and grubbing is performed within the existing areas of the cactus to be transplanted. (Note: Believe it or not clearing preceded transplanting on other jobs because the contractor employees miscommunicated. This statement makes it clear what needs to be done first).

When the cacti are removed and work within the areas to which the cacti are to be transplanted is not completed to the stage at which the cacti can be planted, the cacti shall be stored and maintained until transplanting can be completed.

Removal of cacti shall occur between August 1 and November 1 of the calendar year, while the cacti are in a dormant stage of growth. (Note: The timing also can depend upon climate conditions. We have moved plants later than November 1.)

Each cactus shall be transplanted with at least six (6) inches of its primary root intact. The cactus shall be dislodged and removed by use of a pick axe or similar tool. Each cactus shall be marked on its south face to facilitate replanting to the same sun orientation. Marking of cactus shall be with a non-toxic, water-based material.

The end of the root shall be cut smooth and allowed to callus for a minimum of two (2) weeks before replanting.

Cacti shall be replanted after the two week callus period. However, if that is not possible, the following guidelines shall be used:

If replanting can occur within three (3) months of removal, store the cacti on pallets in the shade. All cacti shall be kept dry and free from insects.

If replanting cannot occur within three (3) months, the cacti shall be planted in temporary containers with one of the following potting mixes:

1. Dry commercial cactus mix.
2. Four (4) parts ground pumice to two (2) parts "Loamex."
3. Prepared potting soil to equal parts sand.

Temporary containers shall be placed in full sun. Do not overwater.

All cacti shall be replanted with the same sun orientation as the original growing site. Specific locations shall be directed by the (title of person in charge).

Transplant barrel cactus will be paid for as extra work as provided in (document that clarifies payment procedures). Note: This last item eliminates the need for a bid, but by including the specifications, the contractor is obligated to perform the work. If it were not included with original package, then the contractor could legally refuse this part of the work and not jeopardize his contract.

Long Term Data on Yucca & Barrel Cactus Salvage for Revegetation at a California Gold Mine

Raymond Franson, Viceroy Gold Corporation, P.O. Box 68, Searchlight, NV 89046

David Boyce, Viceroy Gold Corporation, P.O. Box 68, Searchlight, NV 89046

Beginning in 1991, Viceroy Gold Corporation's Castle Mountain Mine in the east Mojave has salvaged Joshua trees (Yucca brevifolia), Mojave Yucca (Yucca schidigera), banana Yucca (Yucca baccata), and barrel cacti (Ferocactus acanthodes) by hand ahead of mining disturbance. The plants are being maintained in salvage plant nurseries until they can be planted into revegetation areas where mining activity has been completed. To date over 3000 Yuccas trees and over 5500 barrel cacti have been salvaged. This represents the largest salvage of Joshua trees and barrel cacti attempted and provides an opportunity to collect detailed data on salvage methods that will be useful to anyone wanted to transplant a Yuccas or barrel cacti. One difficulty in judging success of transplanting efforts is that doomed Yuccas and barrel cacti can maintain some green tissue for up to three years. All plants are surveyed yearly and rated on a qualitative scale (excellent, poor or dead). Surveys of the plants in the nursery in 1992 and 1993 showed very low death rates for all four species. Death rates in the 1994 survey rose significantly for all species except banana Yucca. The majority of the plants rated as poor in 1992 have since died, while the majority of the plants rated as excellent have remained excellent. This and other data suggest that if the plants are handled properly during salvage and transplantation, all four species can be successfully salvaged by hand on a large scale.

TO.. Mary Platter-Rieger

From... John P. Rieger

RE: Clover on slopes in conjunction with native seed mix.

1. Issue of solution of short-term vs. long term. Clover will sprout and grow quicker than native seed mix. The idea that clover will add nitrogen to soil has no merit since the nitrogen is used up by the plants themselves, and native plants do not require the levels of nitrogen being put into the soil.

2. A substitute plant can be Plantago insularis, however it has a spotty germination habit. Another suggestion is more pounds of plants that do germinate but have little competitive influence. Such as Lupines, Poppy, deerweed, host of other flowering annuals.

3. Recent studies by Viviane Marquez and Scott Eliason show that exotics do compete with coastal sage. In the first year the water uptake zone of grasses is identical to Artemisia californica. Following the first year the influence is greatly diminished. Exotic grasses are successful competitors with the native grasses.

4. Clover, despite claims, will persist on slopes for as much as 5-7 years following application. Quantities in excess of 20 pounds can and often do create a thick carpet shadowing the ground and prevent germination. As only one application is made on a slope the seeds under these "carpets" are lost. Many seeds do require next year germination. Also predation by rodents and birds is a substantial negative influence on the slopes, as well as ants and other insects.

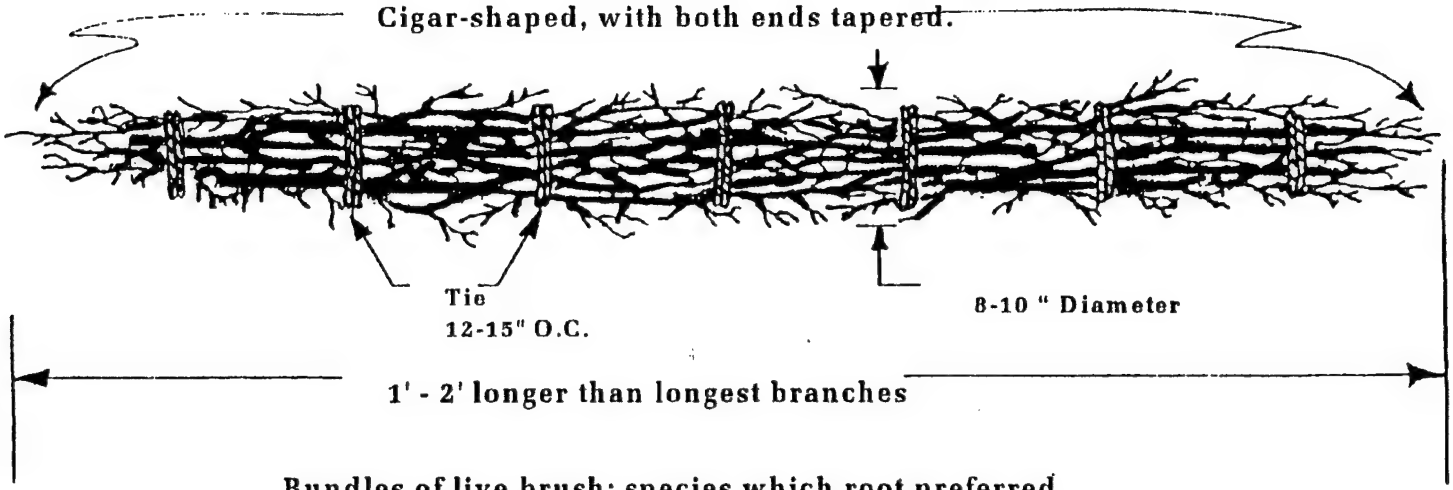
5. Application of rice straw less than an inch thick will have more positive effect than clover. Rice straw eliminates volunteers typical of barley and wheat straw. This can be a serious problem. In some cases we have had non-rice straw bales fumigated to kill the seeds. This has worked quite well. One can easily tell if this was done or not. In the past Caltrans has required it done on site. This can be a hassle, so now we make arrangements for it to be done either at the contractors yard, home office or source. But this is established by mutual agreement beforehand.

6. Clover looks ugly (personal opinion!)

7. I would like to go to the koi steering committee meeting tonight at 7:00pm. Can you make it home by then. They meet now in Old Town! So it won't take very long to get there as before. Hope this helps some, but I do not have time to write a thorough treatise on the subject. Which may not be a bad idea for us to entertain an get put into RE or RMN.?

Appendix H- Erosion Control: Wattling and Cellular Confinement System Specifications

Wattling Bundles

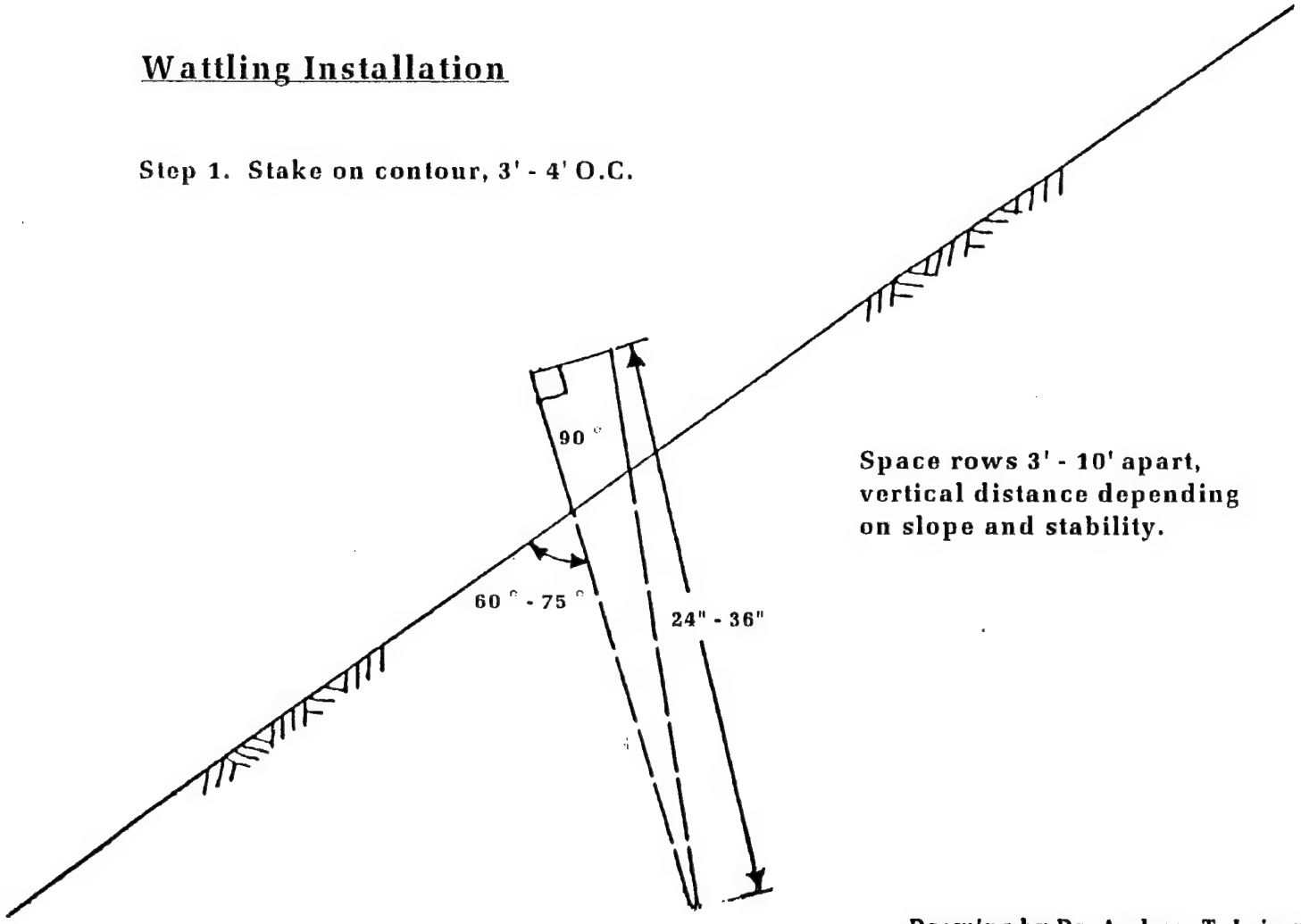


Bundles of live brush; species which root preferred.

Drawing by Dr. Andrew T. Leiser

Wattling Installation

Step 1. Stake on contour, 3' - 4' O.C.

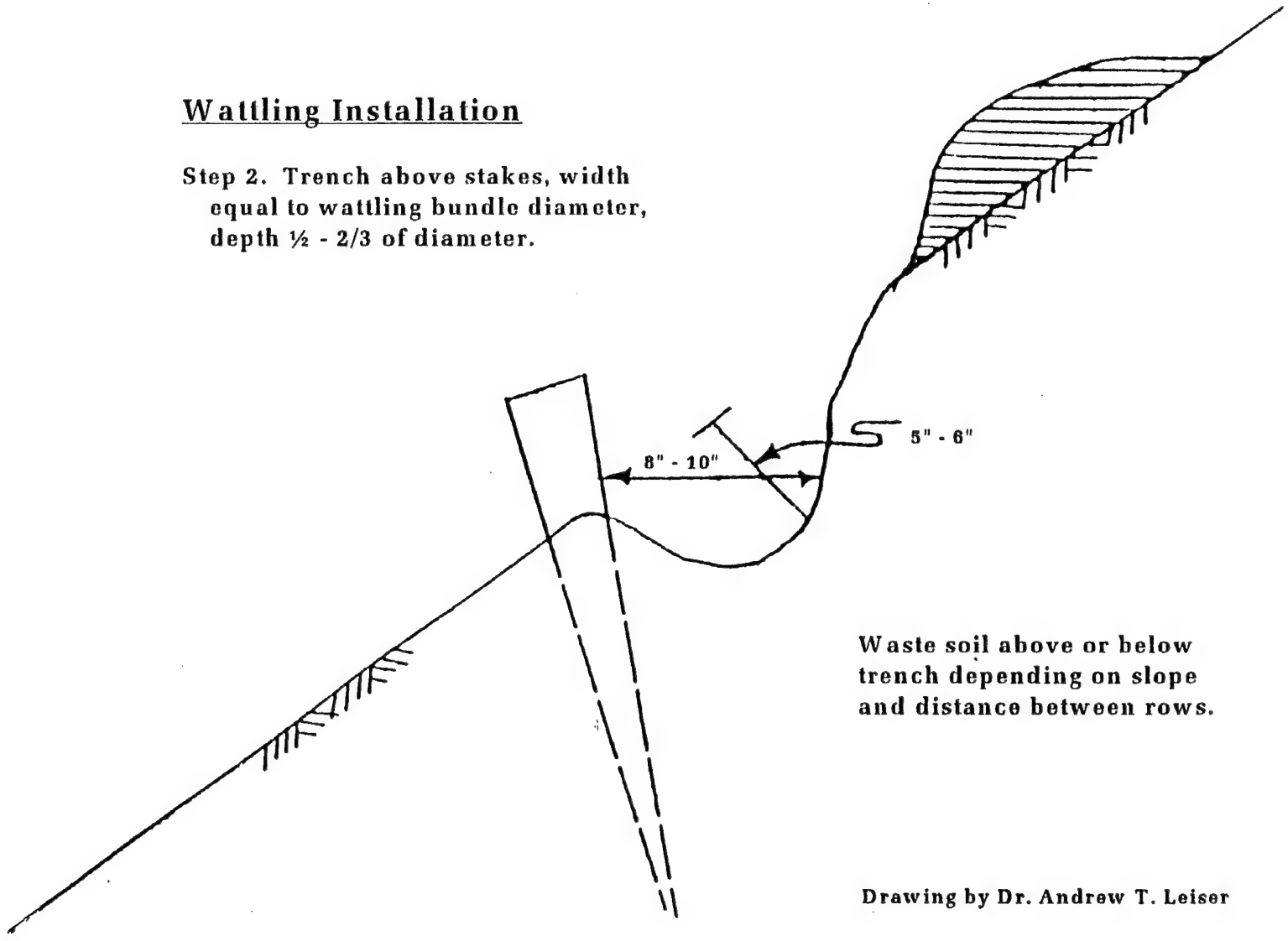


Space rows 3' - 10' apart, vertical distance depending on slope and stability.

Drawing by Dr. Andrew T. Leiser

Wattling Installation

Step 2. Trench above stakes, width equal to wattling bundle diameter, depth ½ - 2/3 of diameter.

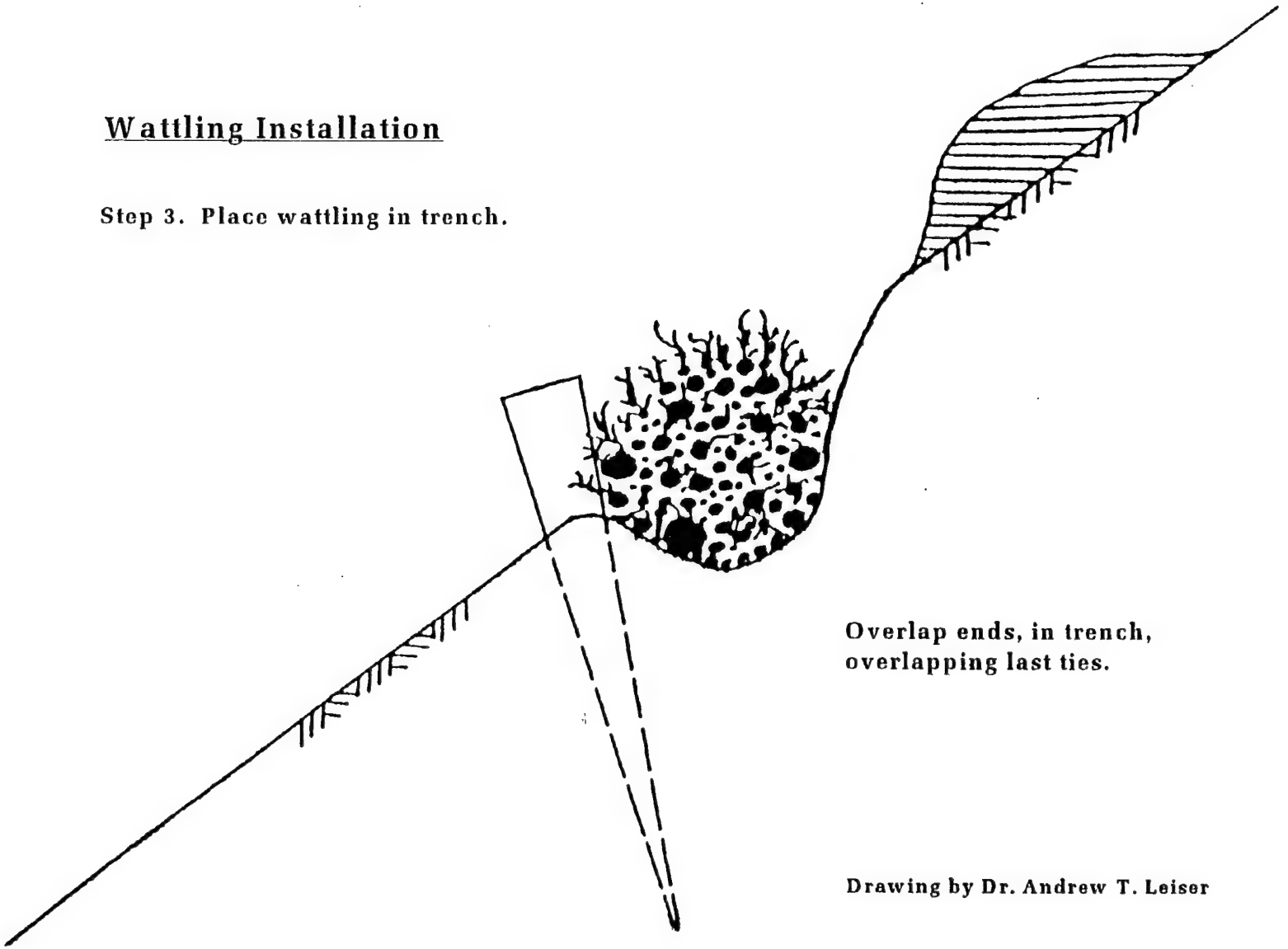


Waste soil above or below trench depending on slope and distance between rows.

Drawing by Dr. Andrew T. Leiser

Wattling Installation

Step 3. Place wattling in trench.

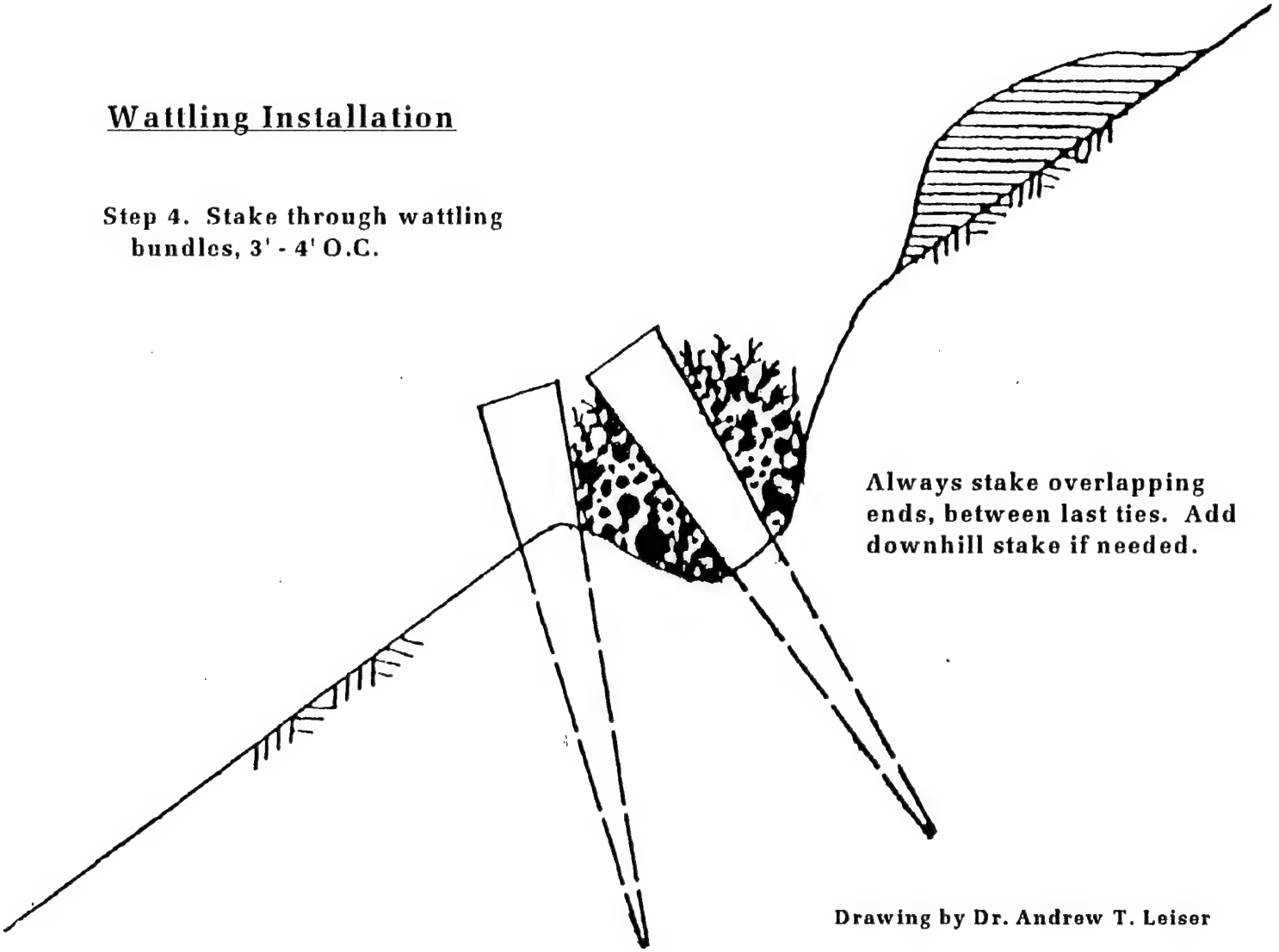


Overlap ends, in trench, overlapping last ties.

Drawing by Dr. Andrew T. Leiser

Wattling Installation

Step 4. Stake through wattling bundles, 3' - 4' O.C.

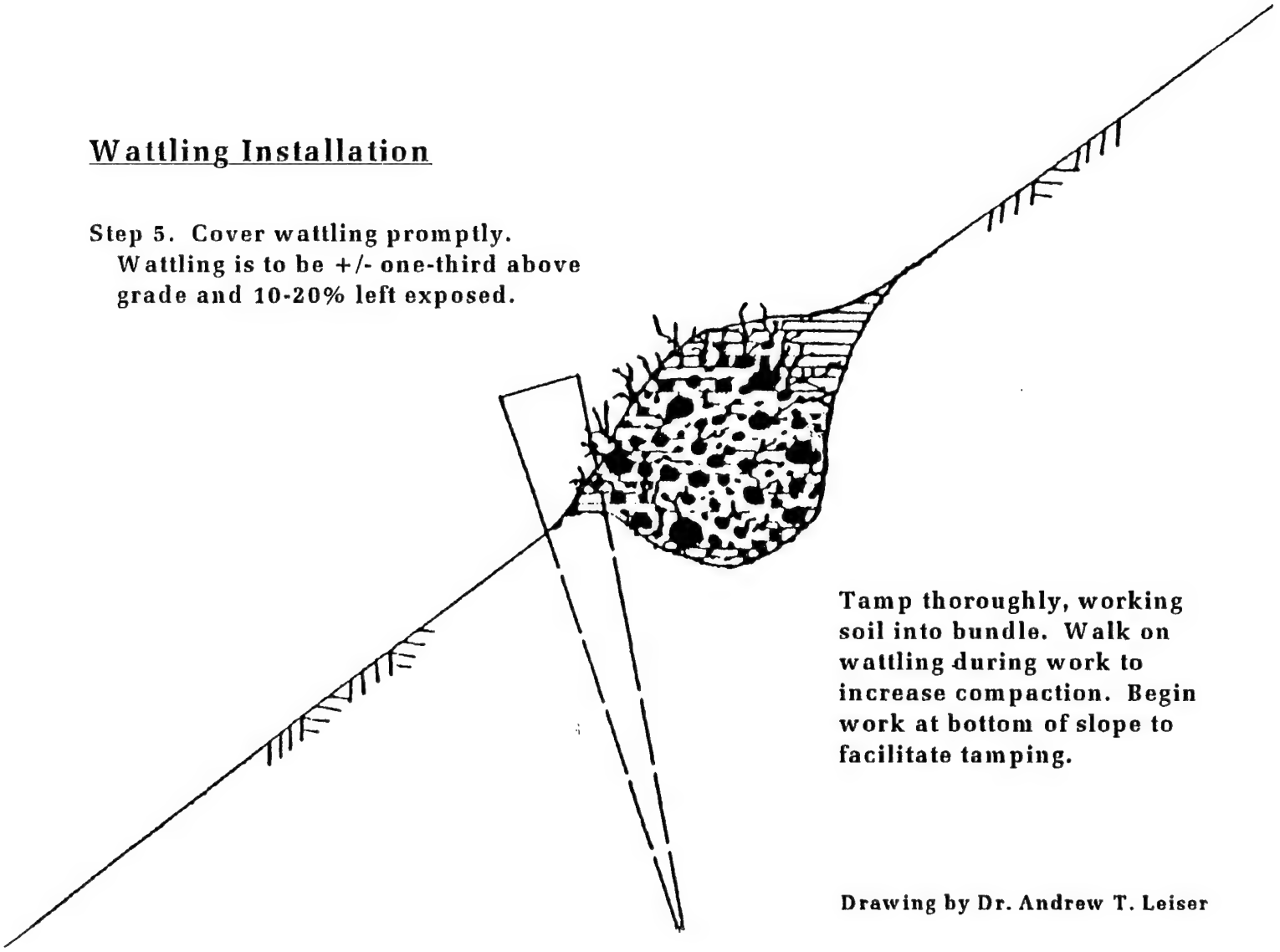


Always stake overlapping ends, between last ties. Add downhill stake if needed.

Drawing by Dr. Andrew T. Leiser

Wattling Installation

Step 5. Cover wattling promptly. Wattling is to be +/- one-third above grade and 10-20% left exposed.

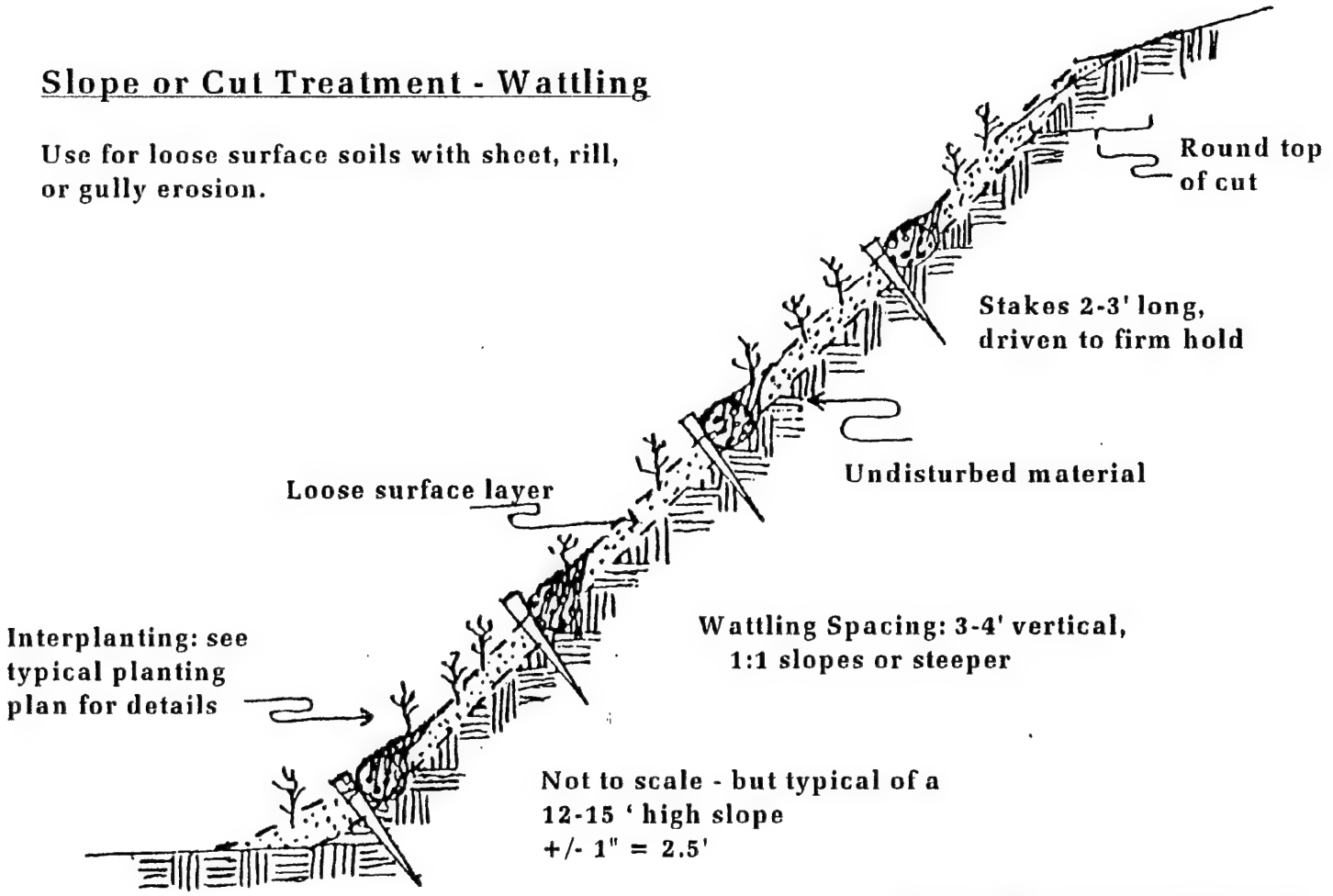


Tamp thoroughly, working soil into bundle. Walk on wattling during work to increase compaction. Begin work at bottom of slope to facilitate tamping.

Drawing by Dr. Andrew T. Leiser

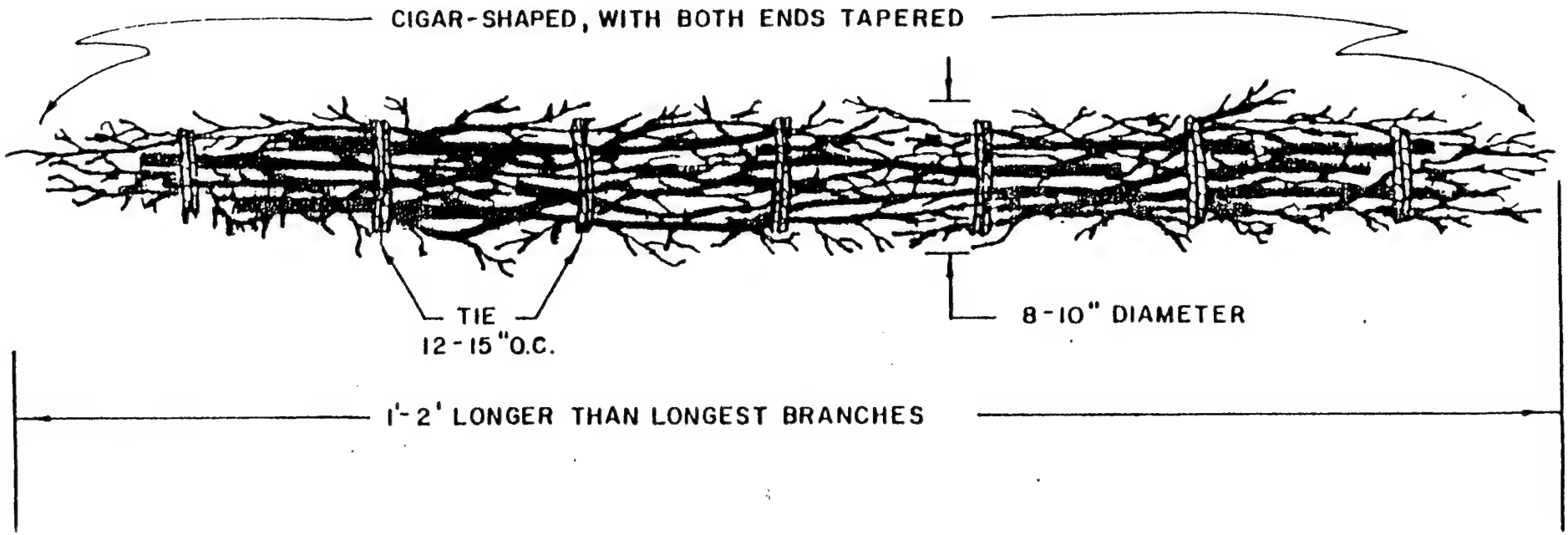
Slope or Cut Treatment - Wattling

Use for loose surface soils with sheet, rill, or gully erosion.



Drawing by Dr. Andrew T. Leiser

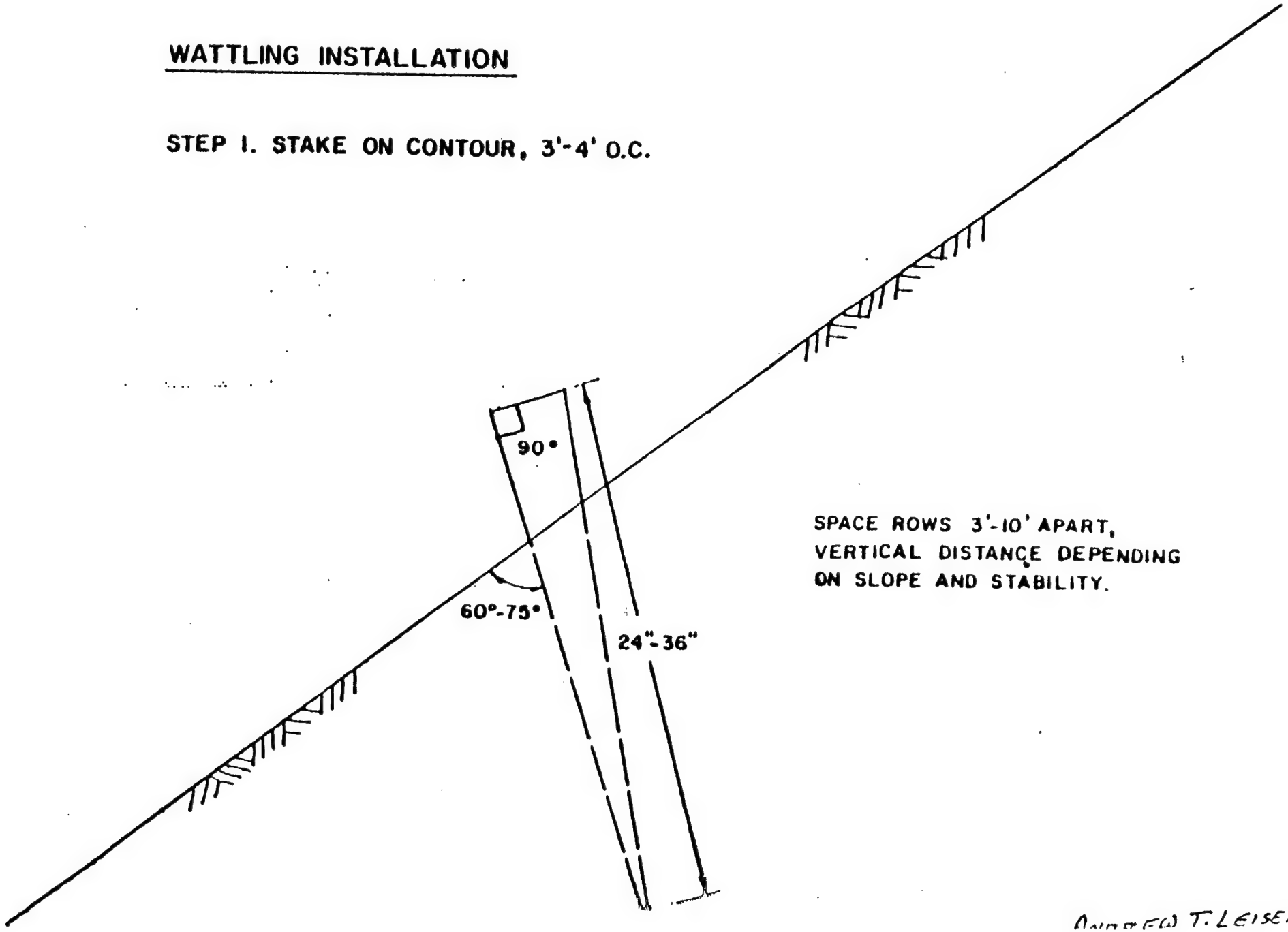
WATTLING BUNDLES



BUNDLES OF LIVE BRUSH, SPECIES WHICH ROOT PREFERRED

WATTLING INSTALLATION

STEP I. STAKE ON CONTOUR, 3'-4' O.C.

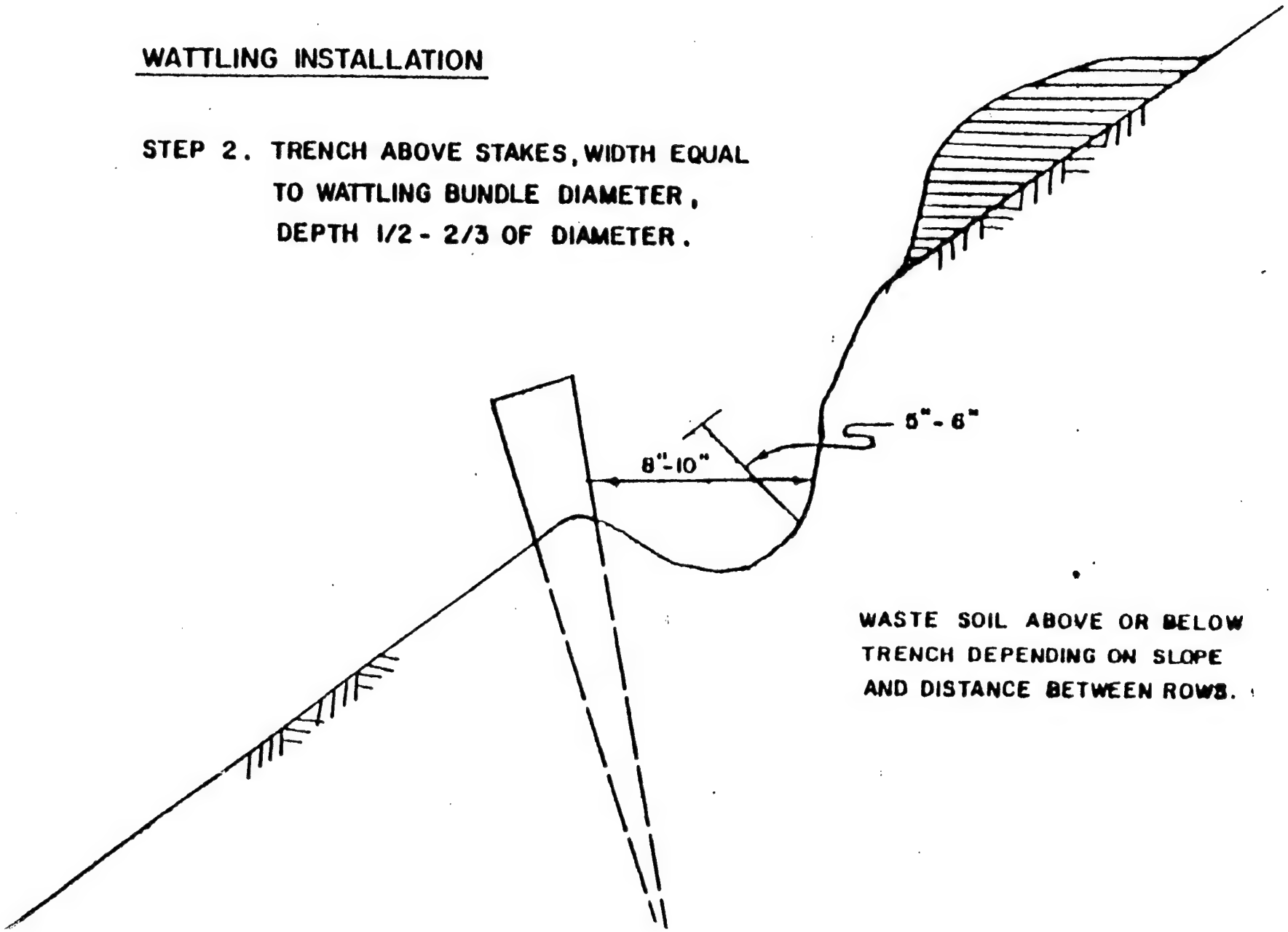


SPACE ROWS 3'-10' APART, VERTICAL DISTANCE DEPENDING ON SLOPE AND STABILITY.

ANDREW T. LEISER

WATTLING INSTALLATION

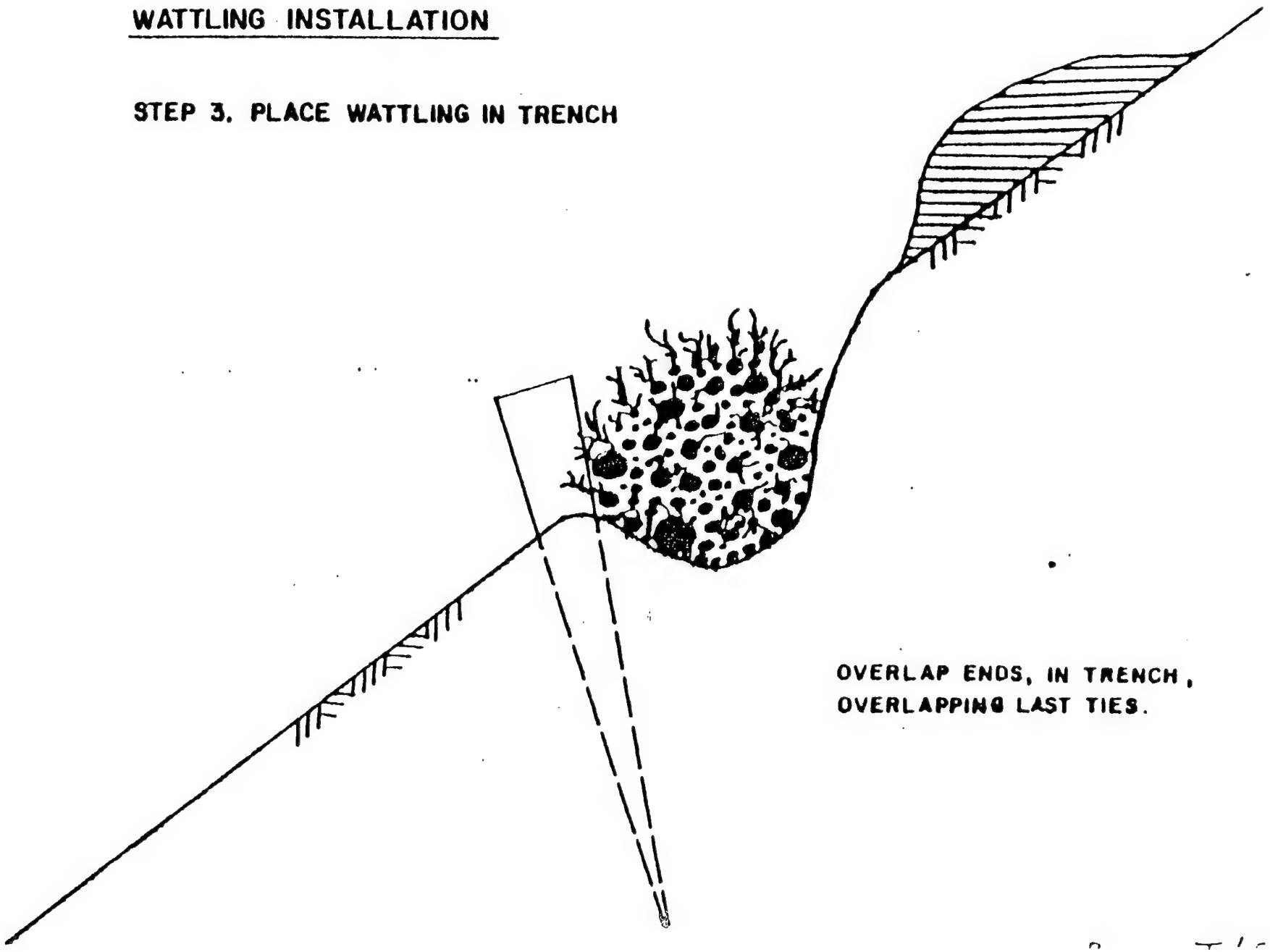
STEP 2. TRENCH ABOVE STAKES, WIDTH EQUAL TO WATTLING BUNDLE DIAMETER, DEPTH 1/2 - 2/3 OF DIAMETER.



WASTE SOIL ABOVE OR BELOW TRENCH DEPENDING ON SLOPE AND DISTANCE BETWEEN ROWS.

WATTLING INSTALLATION

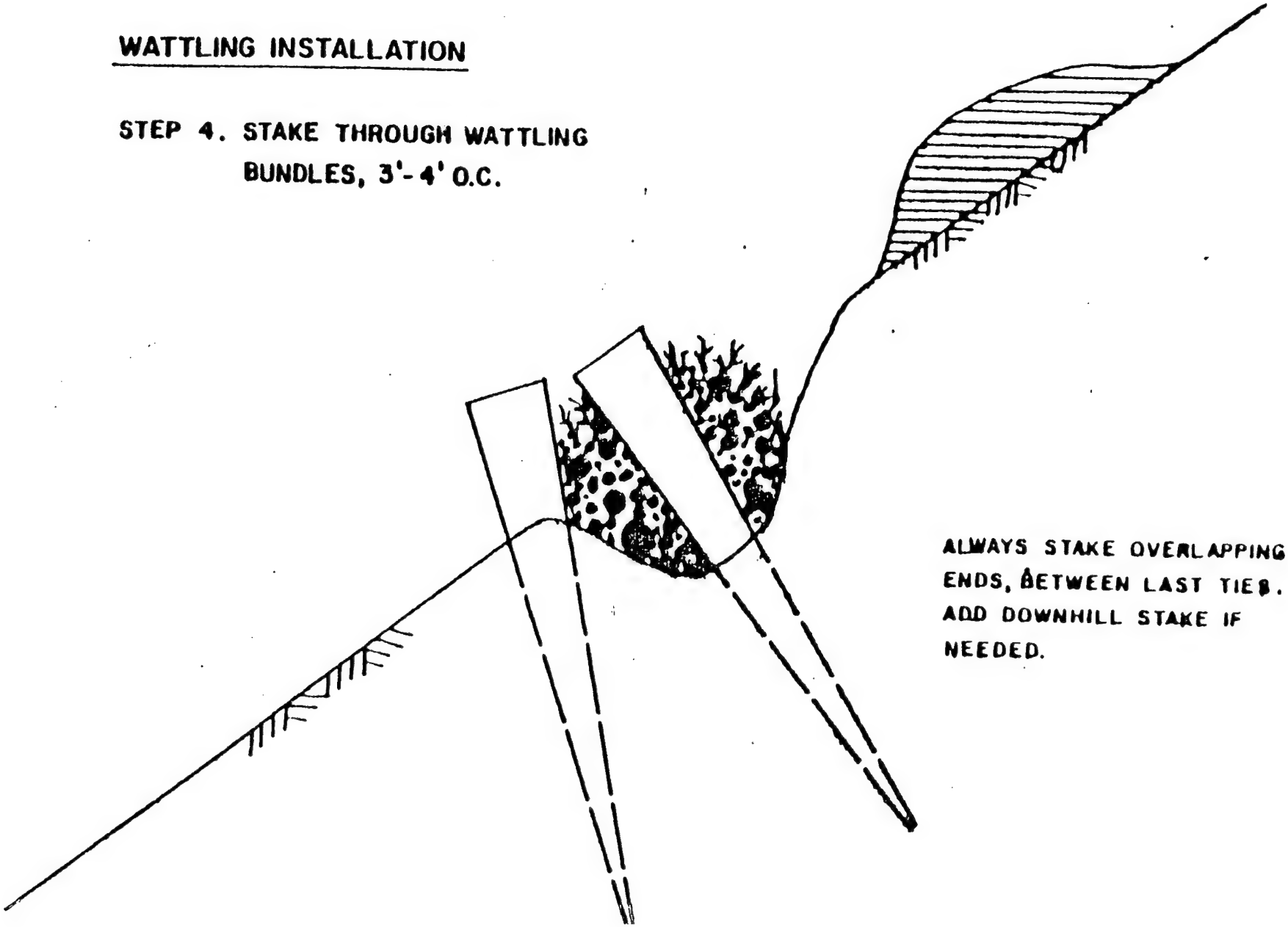
STEP 3. PLACE WATTLING IN TRENCH



OVERLAP ENDS, IN TRENCH,
OVERLAPPING LAST TIES.

WATTLING INSTALLATION

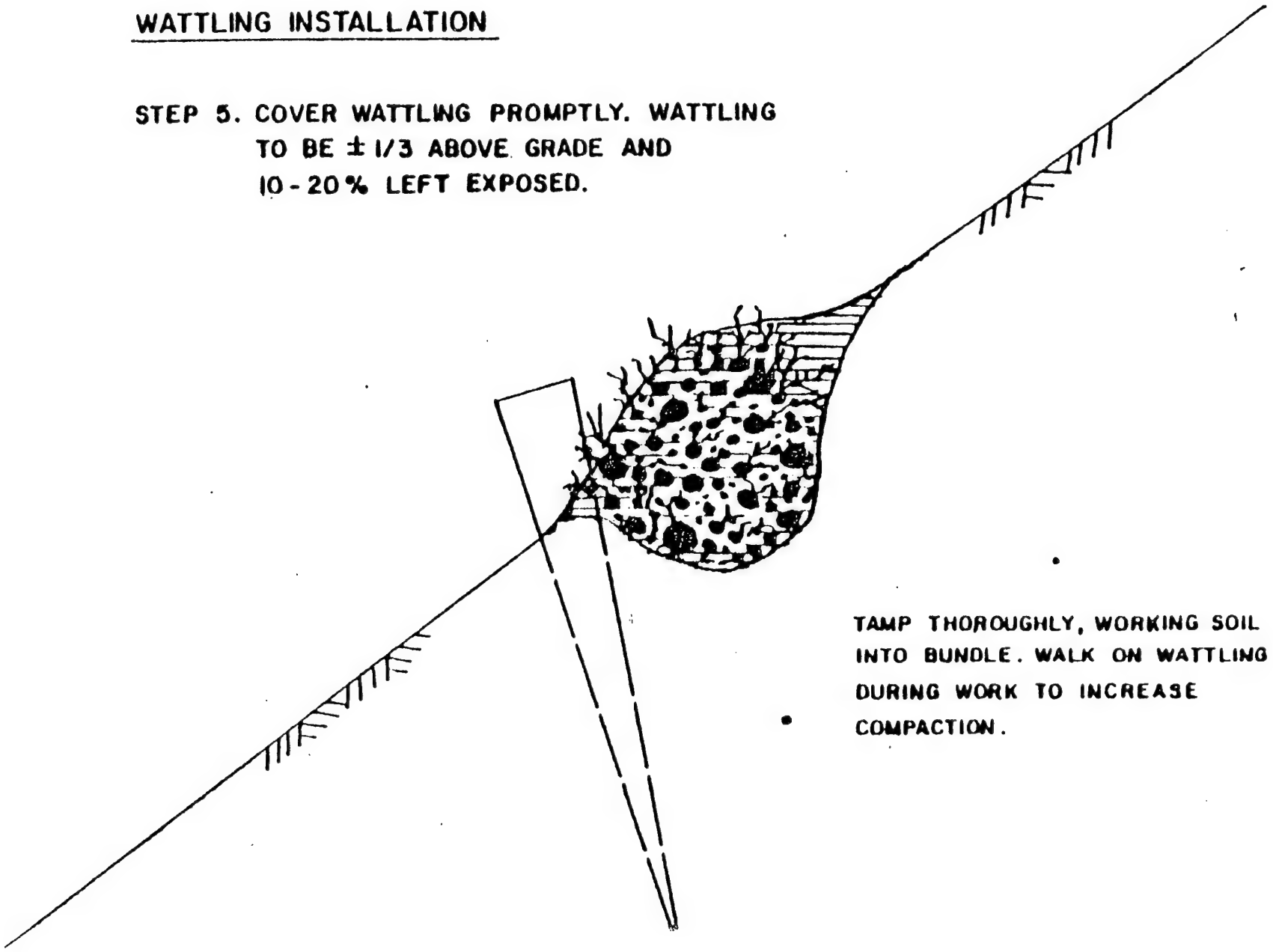
STEP 4. STAKE THROUGH WATTLING BUNDLES, 3'-4' O.C.



ALWAYS STAKE OVERLAPPING ENDS, BETWEEN LAST TIES. ADD DOWNHILL STAKE IF NEEDED.

WATTLING INSTALLATION

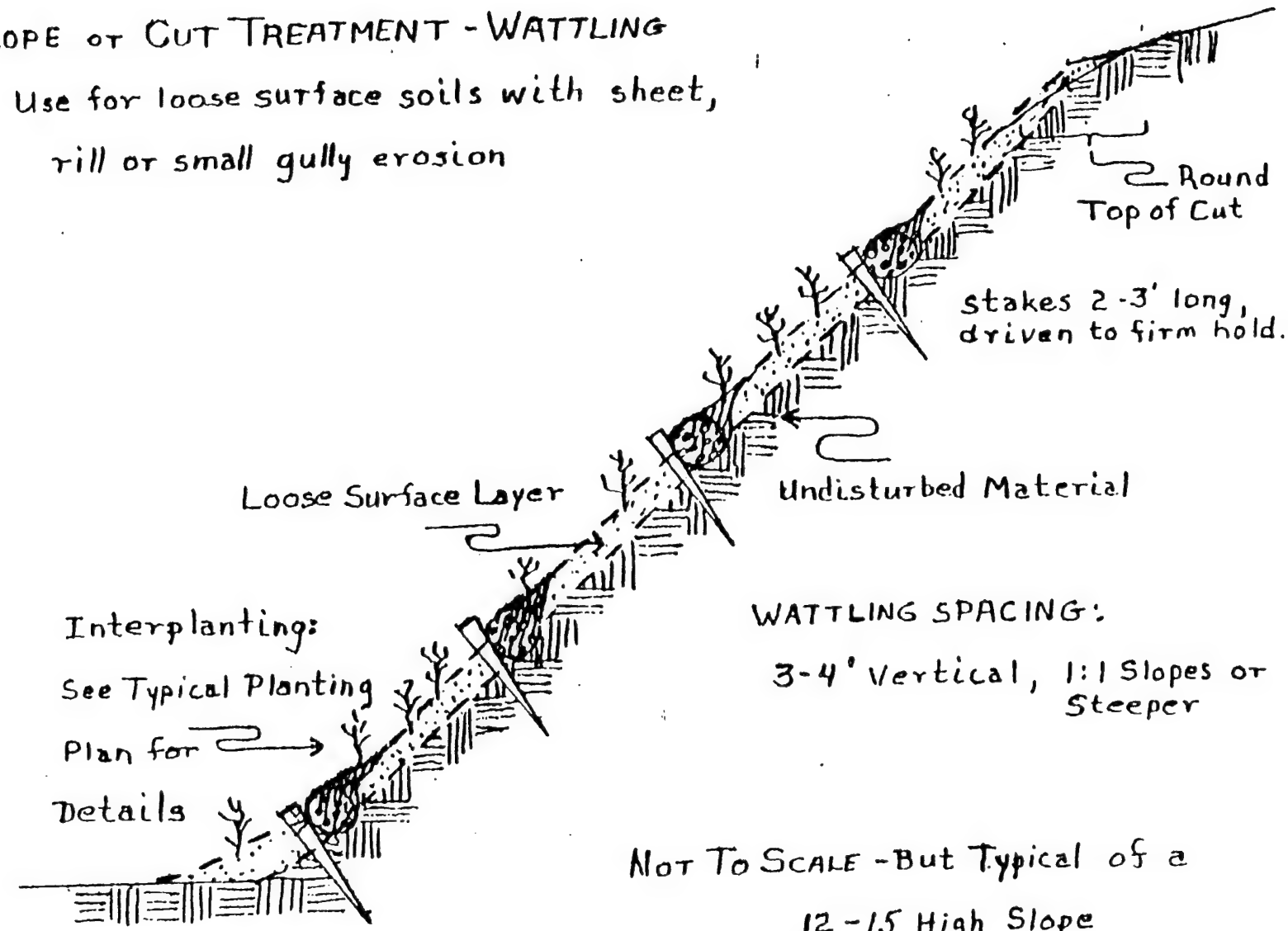
STEP 5. COVER WATTLING PROMPTLY. WATTLING TO BE ± 1/3 ABOVE GRADE AND 10 - 20 % LEFT EXPOSED.



TAMP THOROUGHLY, WORKING SOIL INTO BUNDLE. WALK ON WATTLING DURING WORK TO INCREASE COMPACTION.

Slope or Cut Treatment - Wattling

Use for loose surface soils with sheet, rill or small gully erosion



WATTLING SPACING:

3-4' Vertical, 1:1 Slopes or Steeper

Not To Scale - But Typical of a 12-15 High Slope

± 1" = 2.5'

drawn by Andrew T. Leiser

Geocell/Cellular Confinement Systems Material Specifications
GeoWeb = one trade name for a geocell/cellular confinement system

1. Geocell/cellular confinement system, large cell, is sold by the square foot in panels 8 ft x 40 ft x 4 inches depth and made of textured polyethylene material. Materials properties are listed in Tables 1 and 2.

Table 1. Polyethylene geocell/cellular confinement system (GCS) properties.

PROPERTY	TEST VALUE	METHOD
Specific gravity	0.935 - 0.965	ASTM D792
Carbon Black	1.5 - 2.0	by weight
Sheet Thickness (before surface texturing)	50+/-5% mil (1.25mm)	ASTM D3767
Minimum ESCR	2000 hr	ASTM D1693
Seam Peel Strength	see Table 2	see ASSEMBLY
Seam Hang Strength Test	A 4 inch (102 mm) wide seam sample shall support a 160 lb (72.5 kg) load for 7 days minimum in a temperature controlled environment undergoing a temperature change on a 1 hour cycle from ambient room (74 degrees F +/- 4 degrees) to 130 degrees F.	
Alternative Seam hang Strength Test	A 4 inch (102 mm) wide seam sample shall support a 160 lb load for 30 days minimum in an ambient room temperature (74 degrees F +/- 4 degrees) environment.	
Cell Area	153.6 inches	

Table 2. Geocell/cellular confinement system minimum seam peel strengths.

Cell Depth	Minimum Cell Seam Strength
8 inches	450 lb
6 inches	320 lb
4 inches	225 lb
3 inches	160 lb

Table 3. Geocell/cellular confinement System weight and packaging details.

Cell Depth	Section Weight	Sections/Pallet
8 inches	110 lb	10
6 inches	82.5 lb	14
4 inches	55.0 lb	20
3 inches	41.2 lb	28

ESCR = Environmental Stress Crack Resistance

SURFACE TEXTURE: Both sides of the polyethylene strips which form the cell walls shall have textured surfaces. The surface texturing shall be a multitude of rhomboidal (diamond shape) indentations. The diamond shapes shall have a surface density of 140-200 per square inch and a typical amplitude of 15 mins minimum to 35 mils maximum.

DIMENSIONS: Geocell/cellular confinement system sections, in the expanded configuration, shall have nominal dimensions of 8 feet wide by 40 feet long with depths per Table 2. In the proper expanded configuration, all cells shall be uniform in shape and size and shall measure 16 inches across (in the direction of expansion) with +/- 0.25 inches tolerance.

ASSEMBLY: Geocell/cellular confinement system sections shall be fabricated using 60 strips of sheet polyethylene each having a length of 11 inches and a width of 8 inches. Cells shall be formed using a series of uniformly spaced ultrasonic spot welds joining the strips of polyethylene. Weld spacing shall be 26 inches +/- 0.10 inches. The ultrasonic weld melt-pool width shall not exceed 1 inch. Cell seam strength shall be uniform over the full depth of the cell. Seams shall have minimum strengths per Table 1 and Table 2. Seam peel strength tests shall be conducted using test apparatus capable of standard test pull rates of 2 inches per minute.

PACKAGING: Geocell/cellular confinement system sections shall be palletized for convenient handling per Table 3. pallets shall be strong enough to withstand normal handling by forklift trucks.

CERTIFICATION: The manufacturer shall provide certifications of compliance to all applicable testing procedures and related specifications upon the customer's written request.

WARRANTY: The manufacturer shall warrant each geocell/cellular confinement system section to be free from defects in materials and workmanship at the time of manufacture.

SUGGESTED SOURCES:

Jim Fish
Geoproducts Company
P O Box 441
7367 Noche Tapatia
Rancho Santa Fe CA 92067
Bus Phone 1: (619) 756-3050
FAX Phone 1: (619) 756-0284

Ken Lore
Applied Soils Technology
PO Box 2556
Novato CA 94948
Bus Phone 1: (415) 892-4620
FAX Phone 1: (415) 893-3920

Sam Randolph
Soil Stabilization Products Co.
PO Box 2779
Merced CA 95344
Bus Phone 1: (800) 523-9992
FAX Phone 1: (209) 383-7849

Appendix I- 1980 Nesting Success of Great Blue Herons on Point Loma, San Diego, California

NOSC

NOSC TN 1017

NOSC TN 1017

Technical Note 1017

1980 NESTING SUCCESS OF GREAT BLUE HERONS ON POINT LOMA, SAN DIEGO, CALIFORNIA

Mary F. Platter-Rieger

1 July 1981

Prepared for

Western Division
Naval Facilities Engineering Command

NAVAL OCEAN SYSTEMS CENTER
SAN DIEGO, CALIFORNIA 92152

ADMINISTRATIVE INFORMATION

The work discussed in this document was done in FY80 by Chemistry/ Biochemistry Branch (Code 5131) and funded by the Western Division, Naval Facilities Engineering Command, San Bruno.

Released by
S Yamamoto, Head
Marine Sciences Division

Under authority of
HO Porter, Head
Biosciences Department

ACKNOWLEDGEMENTS

This project was funded by the Western Division, Naval Facilities Engineering Command, San Bruno, and was made possible by the wholehearted support of CDR Don C. Crumbley, Resident Officer In Charge of Construction, San Diego Area, Naval Facilities Engineering Command Contracts, Western, and CDR John C. Hinkle, Commanding Officer, Navy Submarine Support Facility, San Diego.

The author acknowledges with gratitude the expert assistance of Frank S. Shipp, Jr. in monitoring the Point Loma heronry. The author also deeply appreciates the helpful suggestions in the preparation of this report from Frank Shipp and Cliff Hui, Sue Moore, Dr. Elek Lindner and Dr. George Pickwell.

ABSTRACT

The Great Blue Heron (*Ardea herodias*) breeding colony on Point Loma is located on Navy Submarine Support Facility property. Early in February 1980, construction of the access road for a steam plant destroyed 15 of the herons' nesting trees. Construction in the vicinity of the heronry was stopped on 28 February 1980. The Navy initiated meetings with appropriate agencies and knowledgeable organizations to determine the best way to preserve the heronry and to meet Navy construction goals. Since these herons were already highly habituated to intermittent loud noise, construction was cautiously resumed on 14 April 1980, moving the access road as far as possible from the heronry. At that date most herons were incubating eggs and were being closely monitored. Construction was scheduled to halt if the nesting birds showed obvious signs of stress. They did not appear greatly stressed and construction was continued.

Although the Great Blue Herons were actively engaged in pair formation and courtship when the colony was initially disrupted, they did not resume normal breeding behavior until two weeks after construction was halted. However, when compared to previous years, the 1980 breeding season was not delayed. A satellite colony of five nests also formed late in the season.

Seventy-four Great Blue Herons nested in the heronry and 55 were fledged. There were 2.12 young fledged per successful nest for 1980. Although well within the published range of breeding success for Great Blue Herons in California, this value was lower than those observed at the same heronry in 1977 and 1978. Based upon plumage characteristics, at least 10 juveniles and 11 second-year Great Blue Herons nested during 1980 at the Point Loma heronry. Six of the juveniles paired among themselves, fledging one chick and three chicks from the two successful nests. Eggshell thinning and breakage were present in the heronry, although extreme shell thinning occurred in only two or three nests. Data from the first half of the 1981 breeding season indicates that most egg damage was probably caused by stress from nearby road construction.

INTRODUCTION

The Great Blue Heron (*Ardea herodias*) is the largest native North American heron and its breeding colonies constitute an important natural resource. The species is migratory and is protected federally under the Migratory Bird Treaty Act. However, part of the subspecies present in Southern California appears to be resident year around (Palmer 1972, Brandman 1976). Some of the Southern California population probably moves into Mexico for the winter and, like all ardeids, the young disperse widely after the breeding season.

Although Great Blue Herons are present throughout the United States, in recent years the species has undergone significant population declines in many areas. A primary cause of decline is habitat loss, especially nesting habitat. Because of recent continent-wide declines for which pesticides and breeding disruptions were cited, this species was placed on the Audubon Blue List (Arbib 1979) in 1980. Such listing constitutes an early warning signal that a species is having difficulty in maintaining its population levels and if the trend is not reversed, may be changed to a "rare," "threatened," or "endangered" status.

The Great Blue Heron has only three known breeding colonies within San Diego County. They are located on private property near Lake Henshaw, on private property near Via de la Valle Road east of Del Mar, and on Navy Submarine Support Facility property on the east side of Point Loma. Of these three colonies, only those located at Point Loma and Lake Henshaw are large and known to have been successful for a number of years.

The Great Blue Heron breeding colony on Point Loma originally was located in two separate groves of mature eucalyptus trees on two small benches in an old landslide area midway up Point Loma's east side (Figure 1). These were the only large trees on Point Loma in an area seldom frequented by people. Results for the 1980 breeding season of the Point Loma heronry after severe construction impacts are reported in this document and compared to data on this colony collected during 1977, 1978, and 1979. The herons breeding in this location were monitored for the previous three years and were habituated to loud noises. They exhibited no response to close-flying aircraft, vehicle traffic, or distant Navy loudspeaker systems. However, when people were too close to the colony, for instance, closer than the north side of the dump site, the herons typically reacted with the tall alert posture. Many herons would leave their nests if people approached too closely. In previous years the Northwestern Colony contained about three quarters (Table 1) of the active heron nests, so the majority of observations were done from the dump site.

At the beginning of the breeding season, the behaviors of pair formation, courtship and nest repair take place. During this delicate phase of the 1980 breeding season early in February, bulldozers destroyed 15 (all but one) of the Northwestern Colony's nesting trees. Because of an incomplete environmental assessment document, the access road from Rosecrans Street to Navy

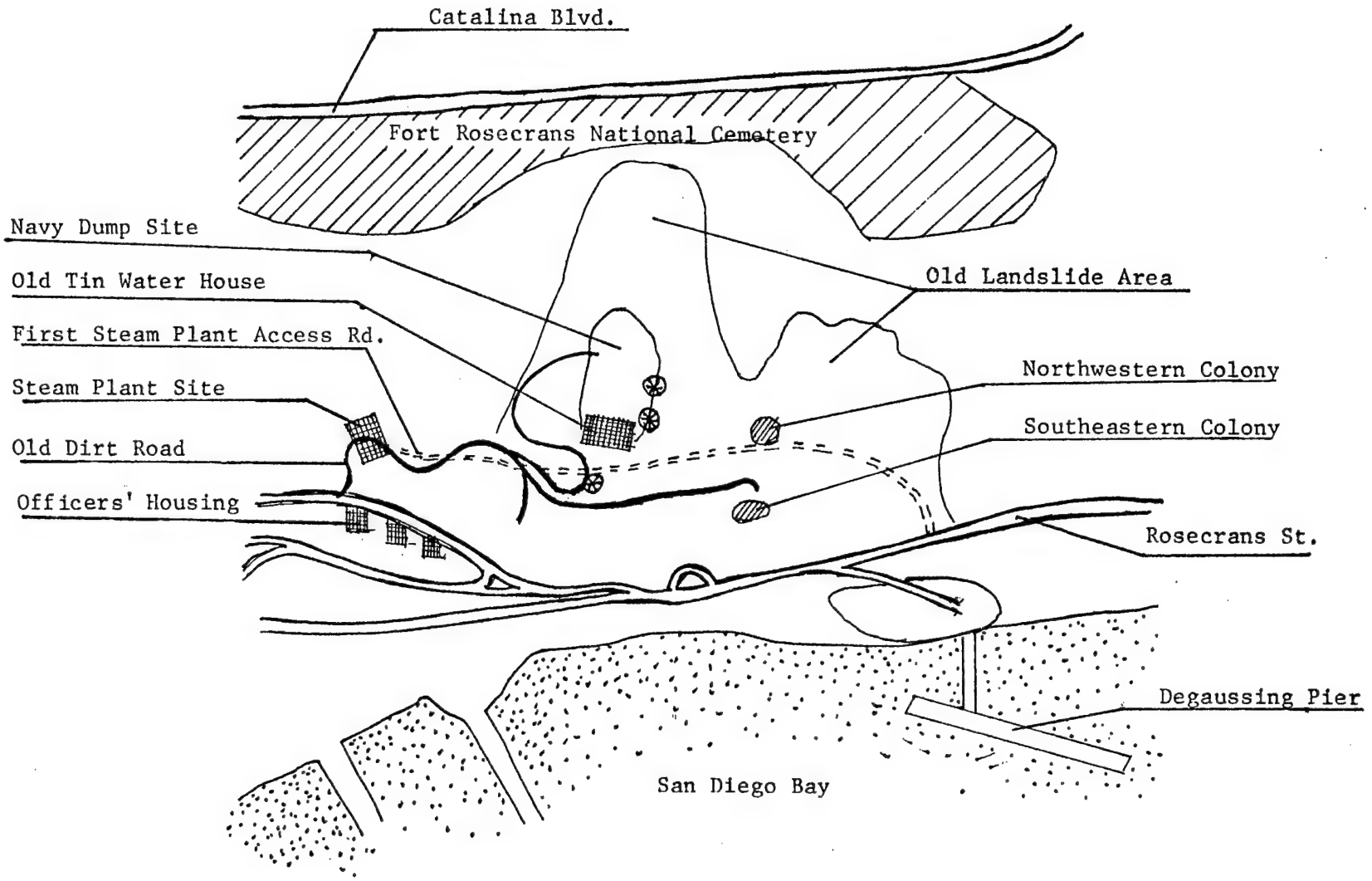


Figure 1. Location of the Great Blue Heron Colony on Point Loma prior to 1980. The proposed contruction, including the access road that destroyed the Northwestern colony, is shown. Asterisks in circles indicate the observation points used prior to 1980.

Project Pier Steam Plant and Distribution (MCON P-042), Navy Submarine Support Facility) bisected the heronry.

Table 1. Point Loma heronry breeding at three different areas within the colony, determined by nest tree location. In 1980, road construction destroyed the Northwestern trees. It is likely that the formation of the Satellite Colony was caused by the subsequent lack of suitable nesting areas in the Southeastern Colony. The apparent increase in total active nests for 1980 is probably an artifact created by less foliage and more observation time.

Year	Total Active Nests	Northwestern Colony		Southeastern Colony		Satellite Colony	
		Active Nests	Total Nests, %	Active Nests	Total Nests, %	Active Nests	Total Nests, %
1977	25	17	68	8	32	0	0
1978	24	17	71	7	29	0	0
1979	27	18	67	9	33	0	0
1980	37	0	0	32	86	5	14

Upon being notified of the heronry's presence in the middle of the construction project, CDR Don C. Crumbley, Resident Officer in Charge of Construction, San Diego Area, Naval Facilities Engineering Command Contracts, Western, halted all construction activity in the vicinity of the heronry on 28 February 1980. He immediately convened meetings with all interested parties. Invited to the meetings by CDR Crumbley were representatives from the U.S. Fish and Wildlife Service; the Marine Sciences Division of the Naval Ocean Systems Center (NOSC), which consults with the Navy on environmental problems; the Western Division, Naval Facilities Engineering Command, San Bruno, where the project design originated; and Dr. Michael Brandman, who had done a study on breeding Great Blue Herons. The main objectives of the meetings were: 1) to find satisfactory measures to lessen construction impacts, 2) to preserve and enhance the remaining Great Blue Heron nesting habitat, and 3) to maintain Navy construction goals.

As a result of these meetings, the remaining tree in the Northwestern Colony was removed on 12 March 1981. At these meetings it was also decided to plant new trees in the Southeastern Colony at the end of the 1980 breeding season and to construct artificial nesting platforms if necessary to rapidly replace the destroyed breeding habitat.

All heron breeding was then concentrated in the Southeastern Colony. The access road itself was shifted westward as far as possible (Figure 2) to be out of sight of the heronry. NOSC accepted the responsibility for monitoring the Great Blue Heron colony to ensure undisturbed nesting. Construction near the heronry was halted until the herons had successfully resumed nesting and were incubating eggs. Construction then resumed slowly and would have been halted immediately for an indefinite period if the monitoring revealed that the colony was being severely stressed.

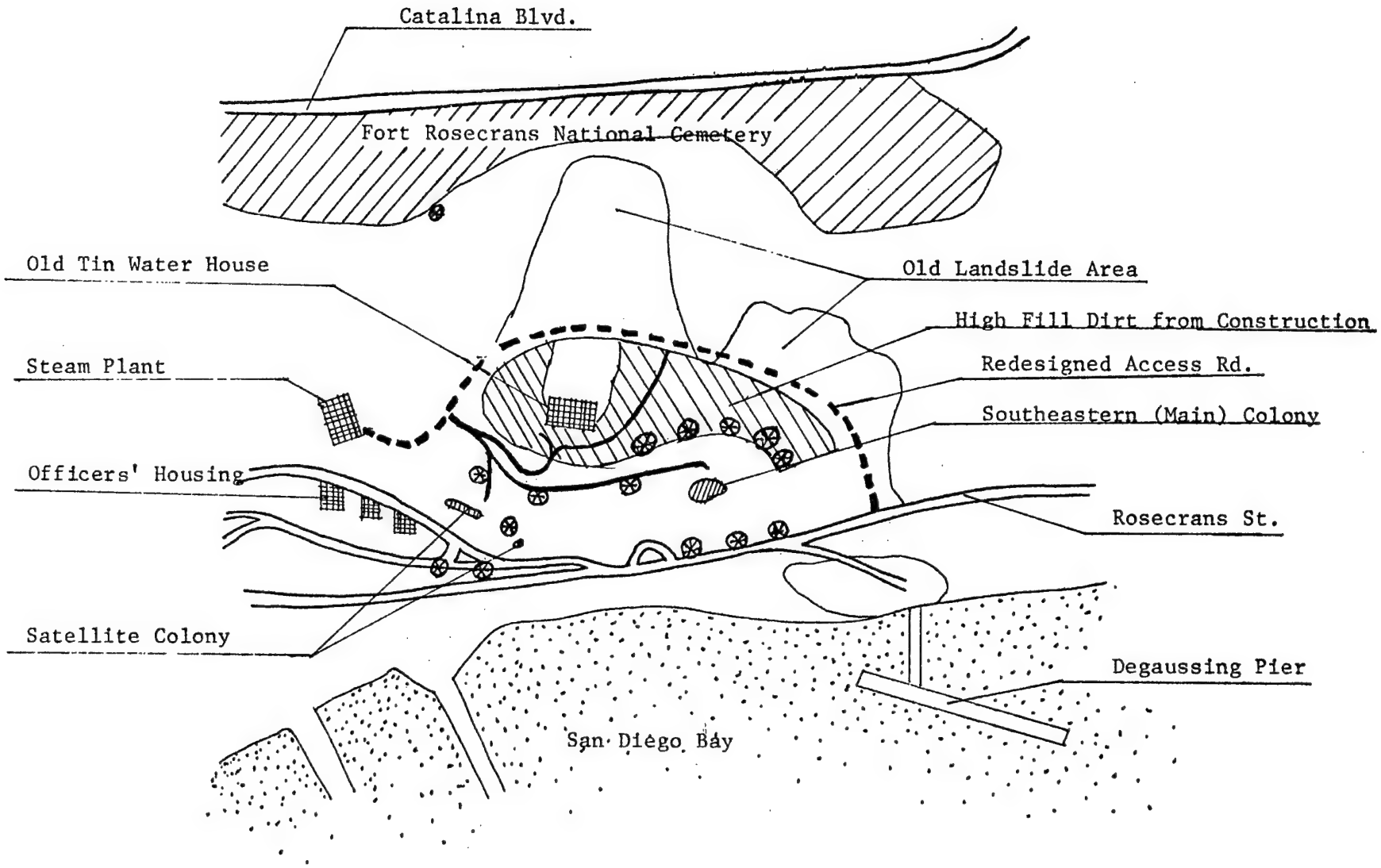


Figure 2. Location of remaining Great Blue Heron Colony, redesigned steam plant access road, and construction artifacts. The circled asterisks show observation points used during 1980.

METHODS

The primary observation points used in previous years were the north edge of the dump site for the Northwestern Colony and an upper turnout of the dirt road leading to the dump site for the Southeastern Colony (Figure 1). After February 1980 the main observation points were located along Rosecrans Street below and directly east of the Southeastern Colony.

The Northwestern Colony had been destroyed and nesting occurred primarily in the Southeastern Colony. Observation points located at the Fort Rosecrans National Cemetery's east edge and later along the fill-dirt west of the heronry provided information on nests that were difficult to observe from Rosecrans Street.

There was no point from which observations could be made into the nests to determine egg condition and clutch size. Also, it was not possible to examine the nests directly since they were about 15-30 m off the ground in eucalyptus trees without low side branches. Late-nesting herons established a small Satellite Colony for the first time in tall eucalyptus trees on top of embankments west and north of officers' housing, Navy Submarine Support Facility (Figure 2). These nests could be observed from several locations along the road by the officers' housing and from the remaining segments of the road to the dumpsite.

All observations were made with a 20 x 6 power Bushnell Spacemaster II spotting scope and either 10 x 40 or 7 x 50 binoculars.

Most observations were done either in early morning or late afternoon when the herons were more active and a more accurate chick count could be obtained. Observation visits were made approximately twice a week during the breeding season in 1980, as compared to weekly or biweekly visits in previous years. During incubation, brief surveys were made under the nesting trees for eggshell collection and dead bird counts two to three times a year in 1977, 1978, and 1979, and once a week in 1980.

Age classes of Great Blue Herons can be determined by plumage characteristics distinctive for one-year olds, two-year olds, and adults three years old or older (Palmer 1962). One-year olds (juveniles) lack the definite black adult shoulder patch and have a slate gray forehead and crown with a very streaked appearing breast and abdomen. Two-year olds and adults are very similar in appearance, but the younger herons have foreheads with smudgy patches of gray extending up into the white crown. Also their pale-tipped lanceolate feathers present in the mantle and on the breast are shorter than those on an adult.

Inferences made from observations were:

- o A heron sitting tightly on a nest was incubating at least one egg.
- o A sitting heron that stood up and then reached down into the nest was considered to be rolling eggs if it made little shoving motions. If its legs were braced and the body exhibited rapid

shaking motions, it was either resettling a nest stick or performing a "twig shake" behavior.

- o If a heron stood up, lowered its head into the nest, then resumed an erect posture, exhibiting a wet, dripping bill or swallowing motions, it was a parent feeding chicks, even if no chicks had been seen.

- o A heron that repeatedly lowered its head into the nest and withdrew it with flicking and shaking motions was assumed to be a parent cleaning the nest after feeding, even if no chicks had been seen.

- o If a chick observed on a nest was not seen again, it was considered dead. However, if it had been at least 56 days old when last sighted, it was assumed to have fledged, unless an appropriately aged carcass was found under or in the nesting trees.

Discarded eggshells were classified as hatched if the opening was at the broad end of the egg. Normal hatching can occur only from the broad end of the egg where the air cell develops. This opening usually has triangularly jagged edges. Often the allantoic sac (embryonic feces) is present at the bottom of a hatched eggshell. A successfully hatched eggshell, if very fresh, will have an inner membrane with a fine, branching network of blood vessels, but without large blood spots, pieces of albumin, yolk, pinfeathers, or flesh. A shell found with any of these features was classified as broken. Broken eggshells were found in fragments or with holes in the waist, or with holes in the sharp end of the egg. Extreme eggshell thinning consisted of eggshells so thin that they flexed when touched and when broken, frequently had edges that were curled tightly inward.

Definition of some technical terms used in this report are as follows. Fledging occurs when a young bird can fly away from the nest. A successful nest is one from which at least one chick is fledged. A failed nest is one from which the eggs were lost or never hatched or all the chicks died.

RESULTS AND DISCUSSION

Although the majority of Great Blue Herons were actively engaged in pair formation and courtship when the colony was severely disturbed, it was at least two weeks after construction was halted before they resumed normal breeding behavior. During this period, most herons remained physiologically primed for reproduction, shown by retention of good breeding colors of the soft parts consisting of blue lores (skin between eye and bill), red-orange bills and faint orangish flush to the legs. They also remained in the vicinity of the heronry but were quick to startle and frequently roosted along nearby piers rather than in the remaining nest trees. There was always a small nucleus of actively breeding herons present in the Southeastern Colony with four nests being incubated and six nests occupied by displaying herons; these birds possibly helped draw back the herons whose breeding had been disrupted. Only rough comparisons between data for 1980 and those of previous years can be made, because the level of effort (Table 2) in these years was

Table 2. Survey efforts, nest present, and nest outcome for the entire Great Blue Heron breeding colony located at the Naval Submarine Support Facility, Point Loma.

Year	Colony Visits	Total Nests	Active Nests	Successful Nests	Failed Nests	Successful Nests
1977	17	26	25	19	6	76.0
1978	7	29	24	22	2	91.7
1979	6	31	27	25	2	92.6
1980	36	38	37	26	10	70.3

lower and foliage configuration of the Northwest Colony did not allow viewing some of the nests. However, timing of the 1980 breeding season appears to have been very similar to that occurring in 1977 and 1978 (Figure 3). The formation of the Satellite Colony late in the 1980 breeding season was probably due to lack of suitable nesting locations within the Southeastern Colony. The number of young fledged per successful nest for this heronry (Table 3) was within the range of published values for other Great Blue Heron colonies in California. However, the Point Loma heronry had a lower number of young fledged per active nest and a higher nesting mortality in 1980 than during any previously recorded year (Table 3).

A survey of Great Blue Heron nesting colonies in Oregon (Werschkal et al 1976) compared seven undisturbed colonies to five disturbed colonies by logging operations. Three disturbed colonies had had recent clearcutting or road construction within 0.5 km and two were newly formed after destruction of the previous year's colony. Nest density and nest occupancy (active nests) were significantly higher for undisturbed colonies. The fledging rate per successful nest at one heronry disturbed by a logging road was lower than that at all but one undisturbed heronry. Unfortunately, nesting success was not determined for the other disturbed colonies. Nesting activity was observed to shift away from the point of disturbance in colonies with logging operations nearby; movement in any direction was not seen in undisturbed heroneries.

The Point Loma heronry during 1980 had a higher nest density in the Southeastern Colony than in previous years, because it was the main area of good nesting habitat into which the disturbed portion of the colony shifted. Comparisons of nest occupancy are not valid because of observational difficulties encountered in previous years. The Point Loma heronry fledging rate was lower in 1980 with road construction present than during previous years, conforming to the pattern observed in Oregon.

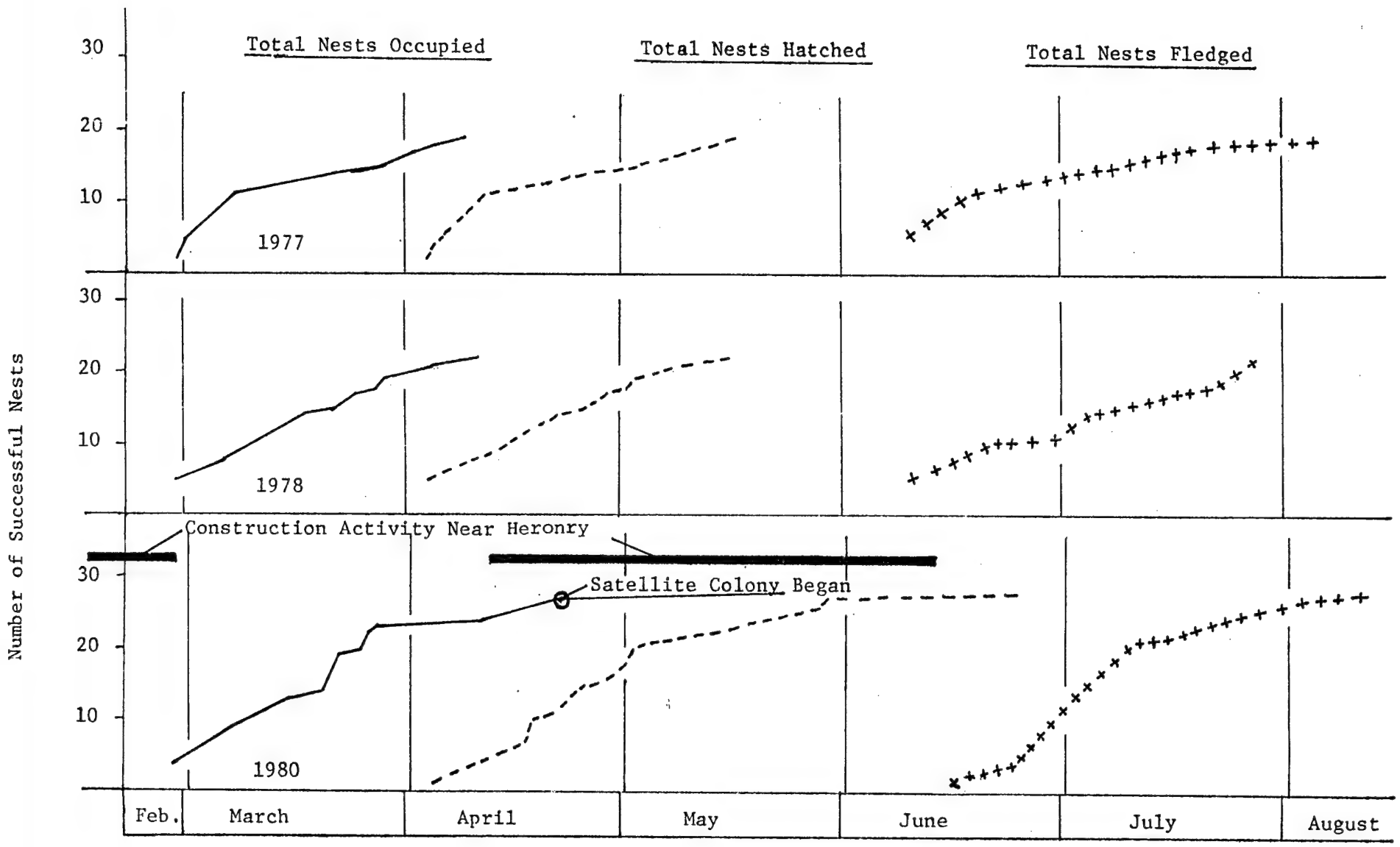


Figure 3. Timing of nest occupancy, hatching, and fledging for the Great Blue Heron Colony on Point Loma for 1977, 1978 and 1980. 1979 was not included because of insufficient data.

Table 3. Breeding effort and success per year surveyed of the Great Blue Heron breeding colony at Point Loma and other nesting sites in California. The years that are most valid for comparison due to higher survey effort at Point Loma are 1977 and 1980. Data are calculated for comparison between years on a per nest basis, not per nesting attempt at the same nest. Data for other Great Blue Heron breeding colonies are presented from the literature.

Years	Breeding Herons	Young Hatched	Young Fledged	Percent Nesting Mortality	Young Fledged Per		
					Breeding Herons	Active Nest	Successful Nest
[1]1967	100			45**			2.2
[1]1968	124			30			2.1
[1]1969	110			19			2.3
[1]1970	100			40			1.9
[2]1971	138		111	15.9	0.80	1.61	2.18
[2]1972	150		120	17.0	0.81	1.72	2.07
1977	50	59	47	20.3	0.94	1.88	2.47
1978	48	--*	52	--	1.08	2.17	2.36
1979	54	--*	50	--	0.93	1.85	2.00
1980	74	76	55	27.6	0.74	1.49	2.12

*Insufficient data.
**Loss of whole broods associated with high rainfall in April.

[1]Pratt (1972), Audubon Canyon Ranch heronry, San Francisco Bay, California
[2]Brandman (1976), Morro Bay heronry, California

The relationship between eggshell thinning and high levels of chlorinated hydrocarbons (especially DDE which is a common metabolite of DDT) in affected birds and their eggs has been documented in many species of fish-eating birds, including the Great Blue Heron (Vermeer and Reynolds 1970, Faber et al 1972). Obvious shell thinning and textural defects were noted in discarded shells collected from the Morro Bay heronry (Brandman 1976), although eggshells were not measured. Great Blue Heron eggshells collected and measured at the Audubon Canyon Ranch heronry (Pratt 1972, and Faber et al 1972) averaged 10.4 percent thinner than pre-1947 museum shells; eggs broken in the nest had shells that averaged 17.2 percent thinner than pre-1947 museum eggshells. The year 1947 was the beginning of widespread DDT usage. Eggshells collected at the Point Loma heronry from 1977 to 1980 include some with obvious thinning, although they have not yet been measured. A moderate level of overall shell thinning can be expected upon measurement of the 1980 eggshells. However, relatively few individuals are suffering from extreme shell thinning. In the

Satellite Colony nesting failures for nests #1 and #4 were directly associated with high numbers of broken eggshells, many of which displayed extreme shell thinning (Table 4). In the Southeastern Colony eggshells could not be assigned accurately to nests.

Several factors complicate interpretation of the significance of observed 1980 eggshell thinning and breakage. Pesticide levels have never been measured in eggs from this heronry. Also loud noise with associated stress from nearby construction was present during the 1980 breeding season. Sustained effects of noise on blood pressure in rhesus monkeys, after the noise ended, have been demonstrated experimentally (Peterson et al 1981). Ratcliffe (1970) states that among birds "there is some evidence that stress can cause a decrease in eggshell thickness" and that "stress is certainly indicated as a cause of parental egg breakage among some species in captivity." Data on eggshell thinning and breakage for future breeding seasons is necessary to indicate whether or not construction stress was likely to have been a significant factor in causing the 1980 egg damage.

Although most herons and egrets probably do not attempt to breed until the breeding season of their second year, records of breeding by Black-crowned Night Herons (*Nycticorax nycticorax*) (Gross 1923), Green Herons (*Butorides virescens*) (Meyrriecks, in Palmer 1962), Little Blue Herons (*Florida caerulea*) (Palmer 1962) and Grey Herons in juvenile plumage (Owen 1959) and (Millstein et al 1970) and a banded Cattle Egret (*Bubulcus ibis*) (Siegfried 1966) indicate that in these species a few individuals attempt breeding at one year of age. Palmer (1962) gives the age of first breeding as two years for Great Blue Herons. Breeding attempts by two juvenile Great Blue Herons were first reported by Pratt (1973). Two chicks were hatched; both died and the nest was abandoned. In 1972, a juvenile female and an adult male were seen copulating; eggs were laid and incubated. However, the adult male was observed to interrupt his incubation and later probably failed to return, forcing the desertion of the observed nest by the female. The nest failed.

At least 10 juveniles and 11 second-year Great Blue Herons nested during 1980 at the Point Loma heronry. Six of the juveniles paired among themselves and each of the three nests hatched at least one chick. One nest fledged one chick and one fledged three chicks, but one nest failed.

Table 5 presents nesting success data for adult pairs and mixed-age pairs. In mixed-age pairs, at least one member is assumed to be a first time breeder. First time breeders generally have a lower nesting success rate than experienced breeders. The mixed-age pairs, with less breeding experience, did have an overall lower nest success rate than the adult pairs. However, they also had a lower chick mortality than the adult pairs. These facts suggest an unexpected possibility: that although mixed-age pairs had a lower quantity of successful nests, their successful nests were of higher quality than those of adult pairs, as reflected in the higher number of young fledged from successful mixed-age nests (Table 5). Second nesting attempts were less successful than first nesting attempts regardless of parental age. Brandman (1976) and Pratt (1972) also found second attempts less successful than first ones.

Table 4. The proportion of broken and hatched Great Blue Heron eggshells collected in both the Southeastern and Satellite Colonies at Point Loma in 1980. Nest by nest details are shown only for the Satellite Colony, since eggshells could not be accurately assigned to nests in the Southeastern Colony.

Colony Location	Fresh	Broken Eggs with Embryonic Development	Total	Hatched	% Broken Eggs	Adult Pairs	Mixed-age and Juvenile Pairs
Southeastern	16	19	35	56	38.5	25	16
Satellite	24	1	25	7	83.5	1	5
Within Satellite					Young Fledged	Comments	
Nest #1	13	0	13	0	0	Failed, all eggshells were obviously thin	
Nest #2	1	0	1	2	2	Hatched 2 chicks Fledged 2 chicks	
Nest #3	2	0	2	3	2	Hatched 3 chicks Fledged 2 chicks	
Nest #4	7	0	7	0	0	Failed, eggshells appeared thin	
Nest #5	1	1	2	2	0	Hatched 1 chick which died; another pair renested and hatched 1 chick which died	

Table 5. Nesting success and failure by nesting attempt and by age class of the herons breeding. Adults are at least 3 years old.

Parental Age	First Nesting					Second Nesting					All Nesting				
	Nests	Successful Nests, %	Chick Mortality, %	Young Fledged/ All Nests	Young Fledged/ Successful Nests	Nests	Successful Nests, %	Chick Mortality, %	Young Fledged/ All Nests	Young Fledged/ Successful Nests	Nests	Successful Nests, %	Chick Mortality, %	Young Fledged/ All Nests	Young Fledged/ Successful Nests
Adult pairs	22	77	36	1.45	1.88	4	25	0	0.50	2.00	26	69	35	1.31	1.89
Mixed-age pairs	15	60	21	1.53	2.56	6	33	25	0.50	1.50	21	52	21	1.24	2.36
Total	37	70	30	1.49	2.12	10	30	17	0.50	1.67	57	62	29	1.28	2.07

CONCLUSION

Road construction damaged the Great Blue Heron nesting colony on Point Loma by destroying 15 of the 26 nesting trees. However, the disturbance was halted early enough and for a long enough time during the breeding season to allow successful nesting in 1980. The higher number of nests present in 1980 is possibly an artifact of a higher level of observational effort and different foliage configurations which presented better viewing conditions. Although there were more successful nests than observed in previous years, there were also even more failed nests, so that the 1980 percentage was lower than in all previous years.

The number of young fledged per active nest was lower in 1980 than in previous years, suggesting stress effects from the disturbance. Eggshell thinning and breakage was present and could have been caused by any one of several factors, but at this time there is no conclusive evidence as to cause.

In comparison to other Great Blue Heron colonies, an unusually high number of juveniles bred and had an unexpectedly high degree of success during 1980. The normal number of breeding juveniles and their success in this colony is not known. Data from more breeding seasons are necessary to clarify this observation.

ADDENDUM: PRELIMINARY NESTING SUCCESS FOR 1981

Preliminary data for 1981 show great promise for a successful breeding season at the Point Loma heronry. Some herons were present on 30 January and 20 nests were occupied on 6 February by Great Blue Heron pairs doing courtship displays. Most of the 37 active nests, 34 in the Southeastern Colony and three in the Satellite Colony, had eggs and were being incubated by early to mid March. Hatching began from mid to late March continuing throughout April. For late nests, hatching occurred in May. A total of 93 chicks were known to have hatched by 5 June 1981.

During the first part of the 1981 breeding season, no broken eggshells were found in the Satellite Colony, although 10 were found underneath the Southeastern Colony. A total of 89 hatched eggshells were found. A statistical test for whether or not the number of broken eggshells per year was associated with construction disturbance (G-test, Sokal and Rohlf 1969) was done. It indicated that the higher number of broken eggshells was significantly associated with the year during which construction disturbance occurred and that this result would occur by chance less than five percent of the time ($P \leq 0.05$). Since the majority of breeding herons during 1980 and 1981 was probably the same individuals, it is likely that the construction disturbance in 1980 was the main reason for the higher observed egg damage. The percentage of eggshells found broken was 50 percent for 1980 and 13 percent for 1981.

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Appendix J- Great Blue Heron and Black-crowned Night Heron Nesting Success, 1991-1996

1991 Great Blue Heron and Black-crowned Night Heron

Census for Naval Submarine Base, San Diego, California

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INTRODUCTION

The Great Blue Herons (*Ardea herodias*) and Black-crowned Night Herons (*Nycticorax nycticorax*) have occupied separate breeding colonies on the tip of Point Loma at Naval Submarine Base, San Diego (Subase), southern California, for many years (Platter-Rieger, 1981, Unit 1984). Great Blue Herons breed locally in scattered colonies (Table 1), then winter widely dispersed over the southwestern United States (Unitt 1984, Root 1988). The Great Blue Herons present in southern California appear to be resident year around (Palmer 1962, Brandman 1976), although most individuals leave the heronry area after the breeding season. Some of the southern California population probably moves into Mexico for the winter and, like all ardeids, the young disperse widely after the breeding season. Unitt (1984) and Root (1988) note that Black-crowned Night Herons are resident year around within this area. Indicating wide dispersal, Ryder (1979) reports recovery, in three different locations in Mexico, of three out of 83 Great Blue

Table 1. *Data on recent heron colonies near San Diego are from Unitt (1984) and Root (1988).*

Recent Heron Colonies Near San Diego

Species	Year	Nests	Location
Black crowned Night Heron	1934-1935		Sorrento
	1950's		Balboa Park
	1960's		Imperial Beach
	1979	many	Buena Vista Lagoon
	1979	53	North Island Naval Air Station
	1980	5	Library and Spreckles parks, Coronado
	1980	6 - 8	East of Old Mission Dam
Great Blue Heron	1972	15	Lake Henshaw
	1974	1	Sutherland Reservoir
	1977	5	Whispering Plams Golf Course
	1979	1	Del Mar
	1980	3	Whispering Palms Golf Course
	1981	1	Crown Point

Herons banded in Colorado from 1929 to 1976. Also 94 of 2,917+ Black-crowned Night Herons banded in Colorado from 1929 to 1977 were recovered from 12 separate locations in Mexico, Colorado, Missouri, Kansas, Oklahoma, Idaho, South Dakota, New Mexico, and Texas.

MATERIAL AND METHODS

All heron colonies were located on Subase, and observed with 40X binoculars from various vantage points on the ground. In March, when most pairs had settled and laid eggs, censuses began. Nests were counted and mapped in each colony unit from 4 March to 3 July 1991 (eight visits). The number of adult herons and their behavior (standing, incubating, feeding chicks, etc.) were noted, as well as the presence and approximate size of chicks. This information was used to estimate the number of young fledged. Lack of time, along with observational difficulties, prohibited collecting the behavioral data needed to estimate young fledged for Black-crowned Night Herons. A representative sample of Black-crowned Night Heron nests will be followed for these data during the 1992 censuses. Four colony visits, conducted from 17 April to 3 July 1991, completed their 1991 nest count.

RESULTS

Great Blue Herons began nesting at the end of January 1991, and had fledged most of the young in August. Figures 1, 2, and 3 show the locations of both Great Blue Heron and Black-crowned Night Heron breeding colonies on Subase for 1980, 1990, and 1991. It is now obvious that the major construction impact to the main Great Blue Heron colony in 1980 (Platter-Rieger 1981) first forced the herons to nest in high densities at the Old Colony site (then the only remaining nest trees at the historical heronry) and to form satellite colonies. These events provided the impetus and necessity for them to expand their nesting activities southward into Officer's Housing, displacing the Black-crowned Night Herons that had historically nested there, and eastward into trees at the Magnetic Silencing Facility. Although not shown on these maps, a small satellite colony has existed since 1990 in pine trees west of Rosecrans Street and Owens Street (private civilian residences). Six scattered nests were active during 1990, though not in 1991, in an area of private civilian residences near San Diego Bay. The nests were built in conifers and in eucalyptus trees east of Rosecrans Street and north of the Scripps Marine Physical Laboratory.

The numbers of Great Blue Heron active nests were down this year (Table 2, Figures 4 and 5), but are still higher than the numbers found in 1980 or earlier. The numbers of Black-crowned Night Heron nests also appear to be slightly lower than in 1990.

Table 3 presents Great Blue Heron productivity (number of young fledged) at Subase, while Tables 4 and 5 present information on Great Blue Herons from published data for other heronries. Table 6 presents productivity information on Black-crowned Night Herons. Insufficient data were collected this year to estimate their productivity at Subase. They began to breed in April 1991, and finished by the end of August. Black-crowned Night Herons build smaller nests, and place them in denser trees than do the Great Blue Herons. They also breed at Subase in higher numbers than do the Great Blue Herons.

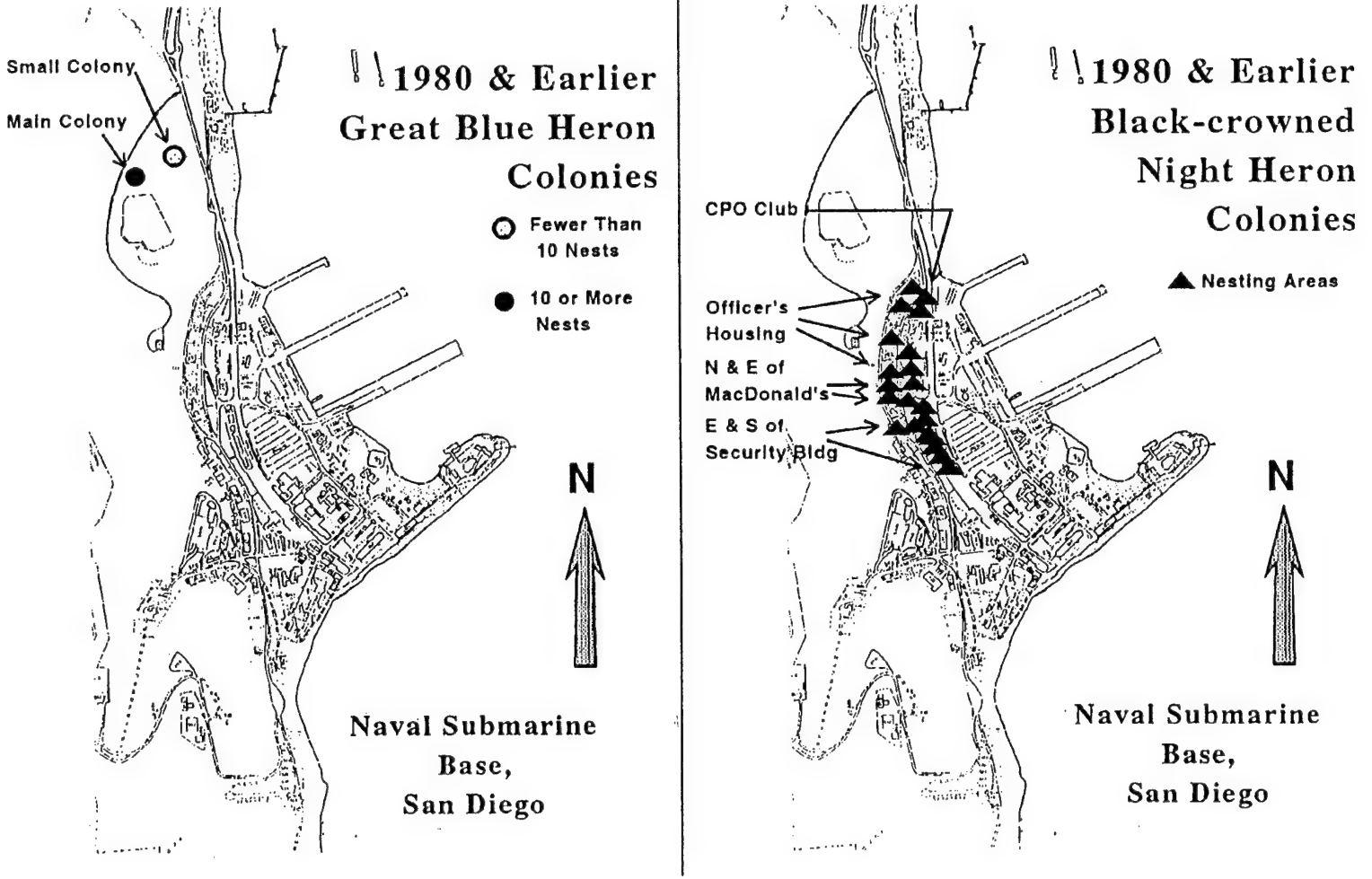

Figure 3. Location of heron nesting sites on Subase for 1980, and for years before 1980.

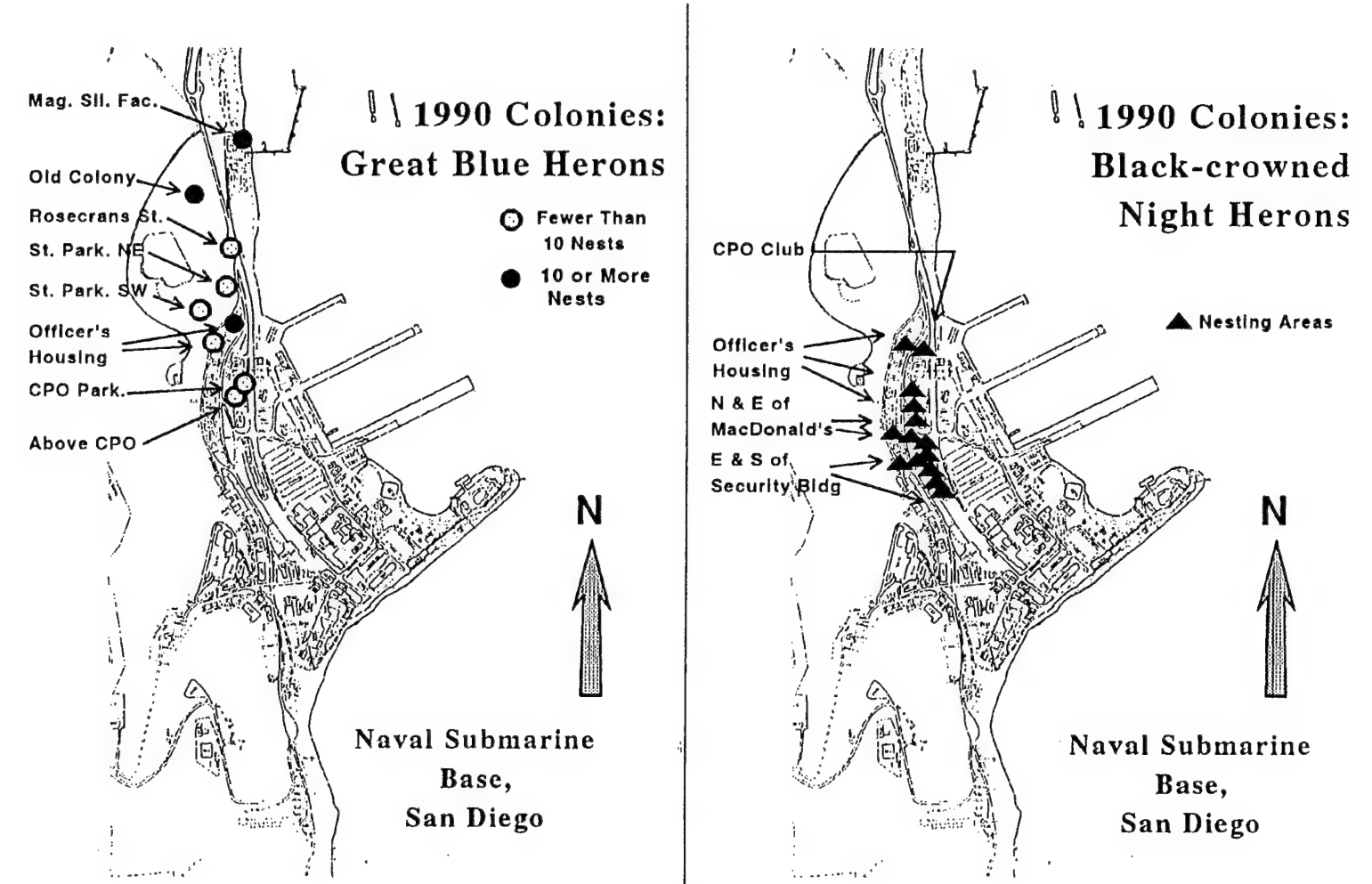

Figure 3. Location of heron nesting sites on Subase for 1990.

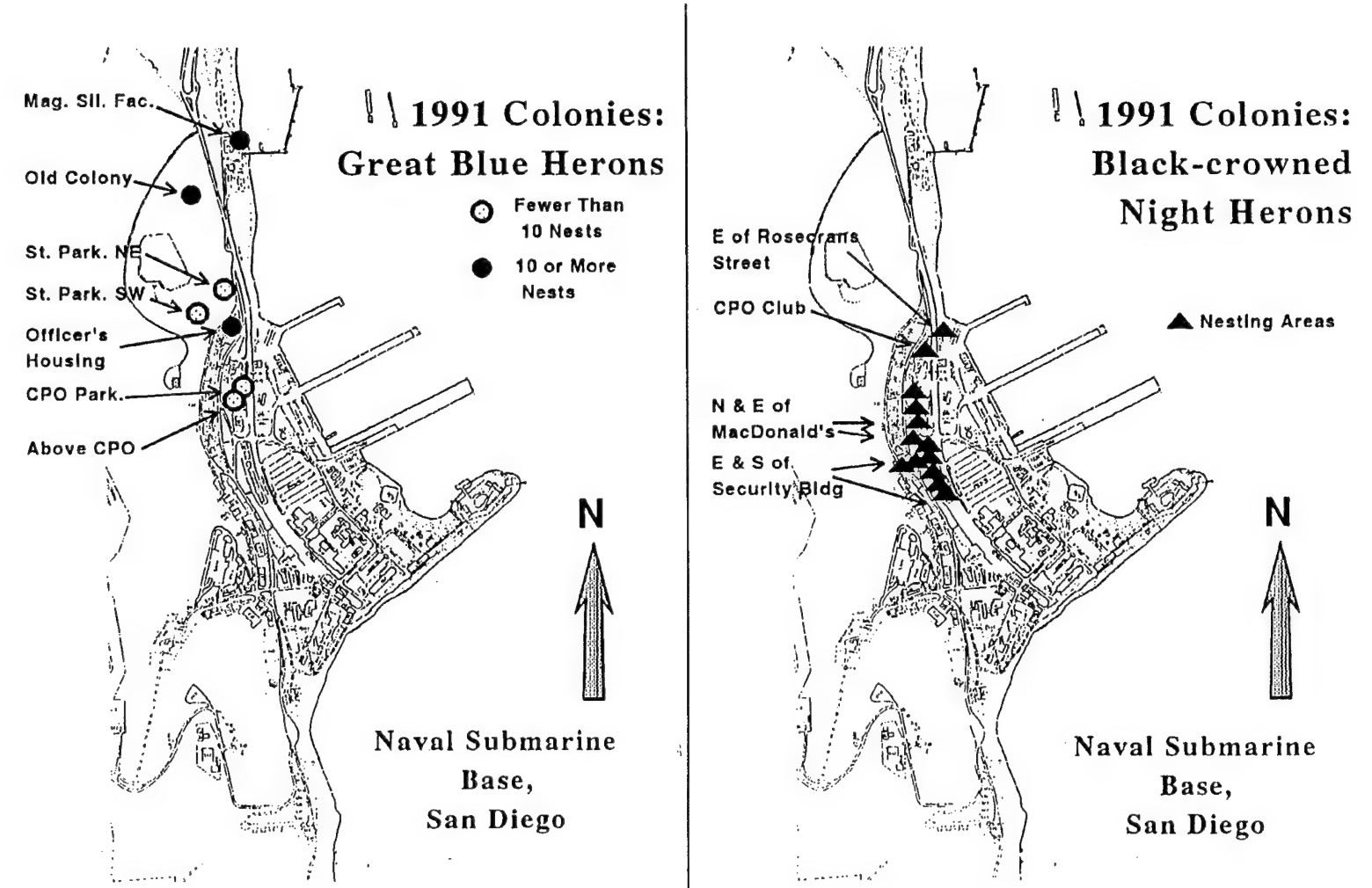

Figure 3. Location of heron nesting sites on Subase for 1991.

Table 2. *Data for both the Great Blue Heron and the Black-crowned Night Heron colonies located at Subase; the sources are listed at the bottom.*

Point Loma Heronries

Species	Year	Colony Visits	Active Nests	Inactive Nests	Total Nests
Great Blue Heron	✣ 1972	1	14		14
	✯ 1977	17	25	1	26
	✯ 1978	7	24	5	29
	✯ 1979	6	27	4	31
	✯ 1980	36	37	1	38
	✢ 1990	2	✓ 61	✓ 26	87
	1991	8	49	33	82
Black-Crowned Night Heron	✣ 1978	2	✓ 157		157
	✢ 1980	4	✓ 100	✓ 8	108
	✢ 1990	1	166	✓ 14	180
	1991	4	112	55	167

✣ Unitt (1984)

✯ Platter-Rieger (1981)

✢ Platter-Rieger (1990)

✓ Estimated Numbers

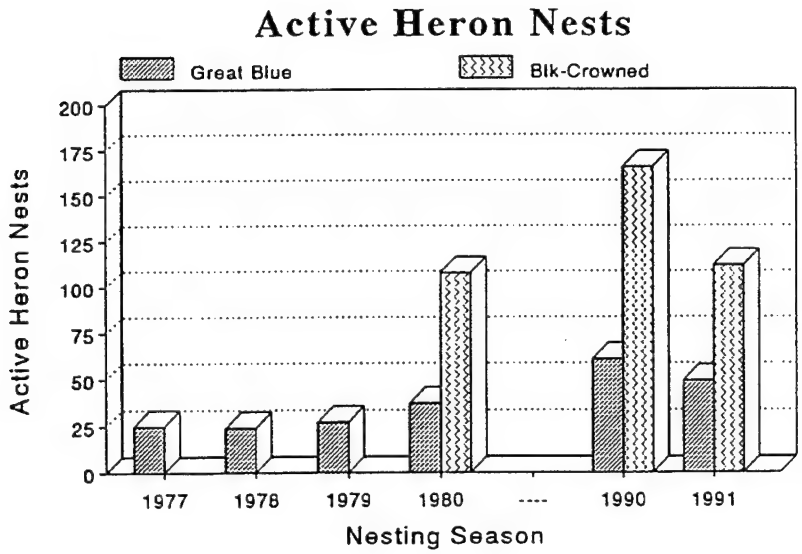

Figure 4. *Number of active Great Blue Heron and Black-crowned Night Heron nests at Subase from 1977 to 1991.*

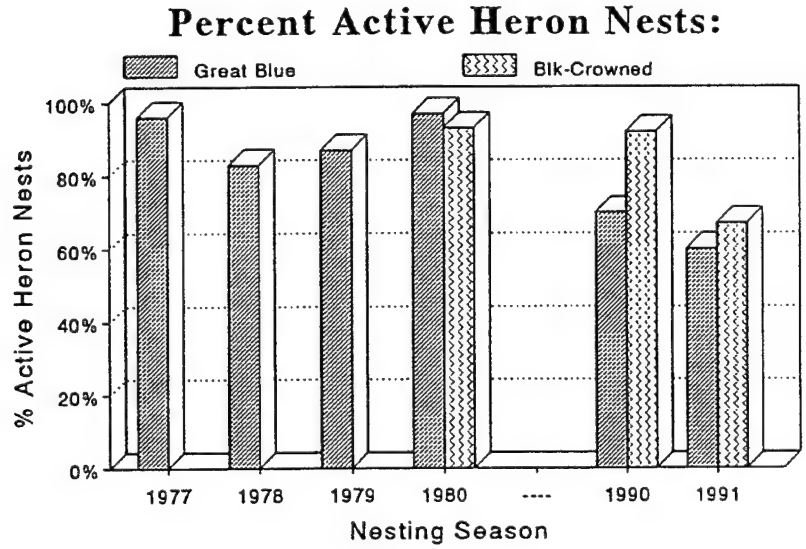

Figure 4. *Acitve heron nests, both Great Blue and Black-crowned Night Heron, as a percent of the total nests present during that nesting season.*

Table 3. *Nest data for the Great Blue Herons at Subase; sources are listed at the bottom.*

Great Blue Herons

Refer.	Year	Herons	Fledged	Fledged/ Active Nest	Fledged/ Successful Nest
✣	1972	28			
✳	1977	50	47	1.88	2.47
✳	1978	48	52	2.17	2.36
✳	1979	54	50	1.85	2.00
✳	1980	74	55	1.49	2.12
✣	1990	122			
	1991	98	71	1.45	1.87

✣ Unitt (1984)

✳ Platter-Rieger (1981)

✣ Platter-Rieger (1990)

Table 4. *Information from published studies of other Great Blue Heron colonies at Audubon Canyon Ranch, near San Francisco, California.*

Great Blue Herons: Other Data

Refer	Year	Herons	Fledg	Fledg/Act Nest	Fledg/Success Nest
✣	1967	100	25		2.2
"	1968	124	37		2.1
"	1969	110	57		2.3
"	1970	100	32		1.9
✙	1971	88	26	1.18	2.17
"	1972	96	35	2.06	2.50
"	1973	116	35	1.00	1.94
"	1974	96	41	1.86	2.16
"	1975	90	22	.85	2.2
"	1976	80	35	1.75	2.19
"	1977	82	21	1	1.91
"	1978	86	28	1.40	1.87
"	1979	70	37	2.06	2.64

✣ Pratt (1972); Audubon Canyon Ranch, California

✙ Pratt and Winkler (1985): Audubon Canyon Ranch, California

Table 5. *Information from the literature on other Great Blue Heron colonies from Ontario; British Columbia; and Morro Bay, California.*

Great Blue Herons: Other Data

Refer	Year	Herons	Fledg	Fledg/Act Nest	Fledg/Success Nest
✻	1964	174	190	2.2	
"	1965	176	224	2.5	
"	1968	62	57	1.8	
"	1972	94	92	2.0	
"	1973	102	100	2.0	
"	1974	100	98	2.0	
"	1975	134	131	2.0	
"	1980	116	114	2.0	
"	1981	138	152	2.2	
✺	1971	138	111	1.61	2.18
"	1972	150	120	1.72	2.07
✱	1977-9	66			2.4

✻ Sullivan and Payne (1988); Ontario, Canada

✺ Brandman (1976); Morro Bay, California

✱ Kelsall and Simpson (1979); Stanley Park, British Columbia, Canada (average of three years)

Table 6. *Information from published studies of other Black-crowned Night Heron colonies located at Sapelo Island, Georgia; North Dakota; and Horicon and Mead Wildlife Areas, Wisconsin.*

Black-crowned Night Herons: Other Data

Refer	Year	Herons	Fledg	Fledg/ Act Nest	Fledg/ Success Nest
✶	1958	8	17	2.13	2.43
❄	1976	114	7	0.23	
❄	1978	118	99	2.20	
❄	1979	194	30	0.57	
✣	1978	50		1.44	2.12
✣	1979	60		2.50	2.50
*	1978	20		1.50	3.00
*	1979	34		2.12	2.40

✶ Teal (1965); Sapelo Island, Georgia

❄ Greenwood (1981); North Dakota

✣ Hoefler (1979); Horicon Wildlife Area, Wisconsin

* Hoefler (1979); Mead Wildlife Area, Wisconsin

DISCUSSION

Miller (1944) stated that an adequate food supply and suitable woods are essentials for Great Blue Heron nesting. He believed that the kind of tree available for nesting was less significant than height, it's distance from human activity, and natural barriers; isolation of the site could be the most important determinant in nesting site selection. Werschkul (1976) compared seven undisturbed Oregon Great Blue Heron colonies to five that were disturbed by logging, and found that nesting activity shifted away from the point of disturbance, and that in at least one case the fledging rate per successful nest in a disturbed colony was very low. The channel markers in the Columbia River used as nest sites by Great Blue Herons were isolated; herons did not nest on the land-based markers along the shoreline, or on markers closest to shore regardless of height (Henny 1978). Tremblay and Ellison (1979) found that visits to Black-crowned Night Heron colonies in the St. Lawrence estuary just before, or during, egg laying provoked abandonment of new nests and loss of eggs.

The Subase Great Blue Herons and Black-crowned Night Herons are unusual, being apparently accustomed to noise and frequent human activity near and directly underneath, though not within, their nesting trees. The Black-crowned Night Herons have always nested in roughly the same locations (Figures 1, 2, and 3) near Officer's Housing, the Security Building, and the Administration Building. Not until construction destroyed much of their original colony in 1980 (Platter-Rieger 1981) did most of the Great Blue Herons move closer to intense human activity. During the past ten years, they appear to have successfully adjusted to the 1980 impacts. There were 24 more active nests in 1990 than in 1980, and 12 more active nests in 1991 than there were in 1980 (Table 2). Two Great Blue Heron satellite colonies in particular are subject to intermittent loud noises, as one is located near large dumpster bins, and the other colony at the Magnetic Silencing Facility near a building that houses a loud generator. Three other successful Great Blue Heron colonies are documented in the literature as being located near or among high human activity. One is in tall eucalyptus trees around an inn parking lot in California (Brandman 1976). Another one is in a single row or western red cedars on Sea Island, British Columbia, sandwiched between the Delta River Inn and the heavily used road to the International Airport (Webb and Forbes 1982). The last one is in an urban setting at Stanley Park, Vancouver, British Columbia (Webb and Forbes 1982).

The phenomenon of high nesting densities caused by the lack, or a perceived lack, of suitable nesting habitat, as was seen at Subase following the 1980 construction impact on Great Blue Herons, has also been observed by Bayer and McMahon (1981) in the Pacific Northwest. They saw high nest densities in four heronries because they were unable to expand: two colonies were located in small groves of trees isolated by sand dunes, and two others were in small suburban groves nearly surrounded by houses. At the Coos-N heronry, Oregon, nest densities per tree nearly doubled in 1976 after a catastrophic wind storm blew down many old nesting trees (Bayer and McMahon 1981). Henny (1978) also describes how the first response of Great Blue Herons to nesting habitat loss was to crowd nests onto every available location on the remaining trees. Then they started nesting on channel markers in the Columbia River, between Washington and Oregon. Evidently responding to a severe lack of safe nesting sites, Great Blue Herons were also observed in 1975 to nest in one meter high sagebrush (*Artemisia tridentata*) on a small, rocky island in the middle of the Columbia River (Henny 1978). Kelsall and Simpson (1979) studied 12 Great Blue Heron colonies, most of them for three seasons, in western British

Columbia. They found that colonies within their study area were fewer, but larger, than in the historic past; probably because urban sprawl destroyed heron nesting habitat.

Bayer and McMahon (1981) also documented cases in which there was an abundance of suitable nesting trees. In these heronries, an average of 26% +/- 15% (range 7-47%) for five years, of a particular year's nest trees were not reused in subsequent years. Abandoned trees did not appear different from the previous year, and subsequent use verified their suitability. For example, eight trees that had been used for at least one year were abandoned for two to three consecutive years before being used again. During this year, previously successful Great Blue Heron nests at the Old Colony, Steamplant Parking Lot 2, Officer's Housing, and the CPO Club Parking Lot went unused.

Great Blue Heron colonies are more dynamic than previous thought. Kelsall and Simpson (1979) found that within the 12 colonies studied, colonies frequently changed location, joined others, split into smaller groups, and perhaps interchanged birds between colonies. Interchange of members between colonies may sometimes account for observed annual variability in nest numbers. Simpson et al. (1987) documented movements of some banded and color marked Great Blue Herons between several colonies. Five individuals moved 24 km to another colony; one individual moved through three colonies within 33 days, while yet two others were seen in one colony during 1978 and another one during 1979. King (1976), in discussing colonial wading bird survey and census techniques, found that annual fluctuations of 50% or more commonly occur in heron populations. Long term studies are necessary to tell if a large change in heron population is permanent, or just a temporary fluctuation. Pratt and Winkler (1985) summarized 13 years of data from a central California Great Blue Heron and Great Egret (*Casmerodius albus*) mixed heronry. They found that the Great Blue Heron breeding population declined from 1973 onward, a decline not matched by a similar decline in reproductive success. There was no relationship between heron population fluctuations (breeding adults) and reproductive biology (number of young fledged, or number of successful nests) in the same, or in preceding years. The two major causes of chick mortality during this 13 year period were starvation and predation; in a sample of 672 heron chicks: 65% fledged, 20% starved, 7% were eaten by predators, and 7% were lost to other causes. The age at which most chicks died varied greatly between years.

Several factors could cause the observed lack of coupling between population numbers and productivity. They include: suspected wide post-fledging dispersal of young; documented exchange of individual herons between colonies both within and between years; and the fact that Great Blue Herons take three years to fully achieve adult plumage and breeding status. All of these circumstances provide a built-in delay between a successful year and next year's breeding population. Although some individuals have been observed breeding in their first or second year (Pratt 1972, Platter-Rieger 1981), few do so, and they are not as successful as adults.

Black-crowned Night Herons also take three years to achieve full adult plumage and breeding status, and have records of juvenile breeding (Gross 1923), although it is rare. Hoefler (1979) found that 13% of Black-crowned Night Heron colonies in Wisconsin were immature birds, and that they did not appear to be nesting. Wisconsin colonies varied in size from one to 702 pairs; the larger colonies were more productive. Colonies smaller than 15 pairs produced few young, and Hoefler (1979) suggests that they may not receive enough social stimulation to complete a nesting cycle, or renest after nest loss. Hoefler (1979) also documented a large population fluctuation; one colony, for no apparent reason, increased from 204 pairs in 1978 to

702 pairs in 1979. Black-crowns, although associated with a single type of wetland, were not restricted to that one only. They preferred wetlands in which the proportion of open water and vegetation were approximately equal and interspersed. Subase Black-crowned Night Herons most probably use San Diego Bay and the San Diego River Flood Control Channel mudflats and any other wetland, as well as the commercial bait-barges, for feeding areas. Unlike southern California, Black-crowned Night Heron nesting success in prairie marshes on the northern great plains is strongly influenced by predation, unstable wetland conditions, and violent storms. For two of five years, dry conditions and/or hot weather prevented nesting. In the two years that nesting occurred, both predation and violent storms caused high nestling mortality. Only in 1978 were most of the nestlings fledged (Greenwood 1981). The weather in San Diego is usually mild, violent storms are rare, and no predation has been observed in the heronery. The censuses for Black-crowned Night Herons at Subase during both 1980 and 1990 are rough counts, and as the numbers of inactive nests were only estimated, it is difficult to attribute any significance to this lower number.

Great Blue Heron nesting in coniferous trees in the Pacific northwest and elsewhere (Julin 1986) damages them to the point of death with heavy nesting use. The main damage occurs through low foliage tolerance to coatings of heron excrement. Needles below the nest are covered with excrement, which causes osmotic burns (chemical damage), and reduces the amount of sunlight available for photosynthesis. It also interferes with gas exchange by plugging the stomata, which are openings on leaves through which gases are interchanged. Nutrient additions to the soil beneath the trees probably acted as a positive influence on tree growth. Long term heron nesting in coniferous forests tends to enhance plant diversity through localized disturbances that allow species occurring earlier in ecological succession to reestablish.

CONCLUSIONS

Both Great Blue Heron and Black-crowned Night Heron nesting populations on Subase appear to be stable and healthy, although more censuses over greater numbers of years need to be done before stability can be claimed with confidence. The numbers of breeding pairs were down from 1990 for both species (Figures 4 and 5). The Great Blue Herons showed the largest decrease. However, the Subase heron population is well within the ranges found for other Great Blue Heron colonies. New information regarding the dynamic and fluctuating nature of many heron colonies, formerly regarded as "stable and fixed," reveals that population numbers commonly change from year to year. These changes are apparently unrelated to the previous season's population of fledged young.

The eucalyptus trees on Subase are physically quite different from Douglas fir trees. Eucalyptus trees tend to have open, umbrella shaped canopies, with few large clusters of leaves below heron nests to catch excrement. On the basis of these structural differences, and my general observations of the overall health of nesting trees at Subase, I conclude that herons do not significantly damage Subase trees.

Suitable nesting habitat is not scarce at Subase, judging from the number of Great Blue Heron nests unused during 1991. Artificial nesting structures, when installed, might be used lightly, or not at all, while unused nests indicate that available nesting habitat is present. Also, given the latest information on the dynamic nature of both Great Blue Heron and Black-crowned Night Heron colonies, artificial nesting structures, if accepted by the herons, may be used intermittently.

They may also need to be in place for some time before herons accept them; Kelsall and Simpson (1979) found an amazing fidelity within each colony to the choice of a single tree species for nesting. This fact held true even in mixed forest when other suitable tree species were readily available. Interestingly enough, the species of choice varied between Great Blue Heron colonies. I also think that designing acceptable structures for Great Blue Herons may be easier than designing them for Black-crowned Night Herons. There appear to be many appropriately dense trees already at Subase not used by Black-crowns. There are no references in the literature to Black-crowns nesting in unusual places, although that is not to say that they are incapable of doing so. Great Blue Herons have successfully nested on duck blinds in Texas (Palmer 1962); an abandoned windmill platform in the St. Lawrence estuary, Quebec (Des Granges 1979); channel markers in the Columbia River, Oregon (Henny 1978); and a transmission line tower in Tennessee (Pullin 1983). A close relative, the White-faced Heron (*Ardea novaehollandiae*), nested for two years on the steel tower housing an outlet valve in Risdon Brook Reservoir, near Hobart, Australia (Wall 1986).

SUMMARY

Both Great Blue Heron and Black-crowned Night Heron populations at Subase appear to be stable and healthy, based on data from this year, previous years, and studies published in the literature. The significance of this year's decline in numbers of Great Blue Heron nests, and especially in the number of young fledged per active nest, can be evaluated only with additional data from future monitoring studies. Heron colonies are dynamic, and long-term monitoring is required to determine significant changes in population trends.

Design and installation of artificial nesting platforms for Great Blue Herons near the Old Colony to compensate for nesting trees destroyed by construction ten years ago, and for those trees more recently damaged by bark beetles, is a worthwhile endeavor. Information in the literature indicates that Great Blue Herons are capable and willing to nest, under certain circumstances, on human-built structures. However, current indications are that available and suitable nesting habitat went unused in 1991. Heron use of artificial nesting structures, and to what extent, under these conditions remains to be seen. The heron excrement problem at Subase is worse during the nesting season for Black-crowned Night Herons, as their major colonies are near roads and parking lots. I doubt that artificial nesting structures can be used to decoy Black-crowned Night Herons into nesting habitat away from their historical spots. They prefer denser foliage for nesting than the Great Blue Herons, which might present design difficulties, and there are no published records that report nesting in unusual places or upon human-built structures. This lack of information does not mean that they are incapable of doing so, or that it should not be tried. However, like the Great Blue Herons, there already appears to be several areas of suitable and unused nesting habitat at Subase for Black-crowned Night Herons. I suggest that accommodation between human activity and Black-crowned Night Heron nesting be done through careful tree trimming and landscape planning to direct future colonies away from roads and parking lots. I suggest temporary or permanent parking lot and walkway covers during the breeding seasons for problem areas where colonies are already established. As both of these herons are federally protected under the Migratory Bird Treaty Act, all plans for artificial nesting structures, or other habitat modifications, must be discussed with U. S. Fish and Wildlife Service before implementation.

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HERON NESTING AND STEATITIS ON POINT LOMA, 1992-1996

by

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NCCOSC RDTE DIV D3621

20 Feb 97

Introduction

Monitoring of both great blue heron (*Ardea herodias*) and black-crowned night heron (*Nycticorax nycticorax*) breeding has continued from 1992 through 1996. Steatitis, or yellow fat disease, is a dietary deficiency-disease that has been present intermittently in San Diego great blue herons (*Ardea herodias*) and black-crowned night herons (*Nycticorax nycticorax*) at a low level for at least 15 years. Beginning in 1991, steatitis has been present continuously and at increasing levels every year.

Methods

Visits were made to the various colony sites ranging in frequency from several times a week through every one to three weeks, depending on weather and other projects. Nest maps were constructed or updated for every site, and observations were noted on the maps. In 1995, fifty great blue heron chicks were banded on 25 March and 15 April, and wing-tagged with a large yellow and black tag if they were old enough to have sufficient patagial skin. Nineteen black-crowned night heron chicks received leg bands on 15 April and 24 May 1995. Seven subadult and adult great blue herons and one adult black-crowned night heron were banded, and the great blue herons were also wing-tagged, during 14-16 May 1996. A boom truck was necessary to reach the nest platforms and catch the chicks; a combination of foot-snares and a net-gun were used to capture the older herons.

Conclusions

In terms of specific nesting locations, the Point Loma area is a large meta-colony composed of subcolonies (figure 1 and 2) among which some of the herons switch back and forth every year. Some nest sites are always in "fashion", others are abandoned after a single season, still others may be reused four years later. The great blue heron breeding population, in total, has increased and appears fairly stable (figures 3, 4, 5, 6, 7, and 8). Unfortunately, the black-crowned night heron population has declined steadily (figures 2 and 12) for unknown reasons. Steatitis may have been a contributing factor, but the great blue herons have lost more individuals to this disease than have the black-crowned night herons, and their populations have increased somewhat. Both species take four years to attain adult plumage; 1997 will be the fourth year since the steatitis epidemic became heavy, so the breeding records for that year will be quite interesting. To complicate matters, I suspect, based on information in the literature, that possibly up to forty percent of any years' breeding population may be herons originating from some other natal colony. Only a prolonged banding and tagging program can answer this question.

Steatitis caused the direct 40% loss of chick production in the Point Loma heron colonies in 1994. Steatitis was present again in 1995 at even higher levels (figure 9), which dropped back to about 1995 levels in 1996. The great blue herons suffer greater losses due to steatitis than due the black-crowned night herons (figure 10). The great blue heron active nests match the same pattern of steatitis cases for 1994-1996 (figure

11); black-crowned night heron active nests just keep going down over time while steatitis increases or stays level (figure 12). Young herons of both species are the main steatitis victims; adults and subadults are affected occasionally in the last three years (figures 13, 14, 15, 17, 18, 19, 20). There is a distinct seasonal component to steatitis in the San Diego area. When we handled young herons for banding on 25 Mar 95, 15 Apr 95, and 24 May 95 (black-crowned night heron young only), not one showed any signs of steatitis. But when banding large great blue heron chicks on late nests during 30 Aug 96, all four young herons handled had severe steatitis. These facts match the steatitic pattern shown in figures 13 and 17. Steatitis in general can be caused by: rancid fish oils or high dietary levels of poly-unsaturated fats causing low levels of vitamin E (Helgebostad and Ender 1973, Van Vleet 1977, Carpenter et al. 1979); low selenium levels (Van Vleet 1977, Foreman et al. 1986); high levels of silver, zinc, cadmium, tellurium, cobalt, copper, mercury, tin, lead, iron, arsenic, sulfur (Van Vleet 1977, Van Vleet 1982a, Van Vleet 1982b,), and poly-chlorinated biphenyl (PCB's) (Combs and Scott 1975, Combs et al. 1975); or viruses (Hashmoto et al. 1985). Blood samples, taken and analyzed in 1995, eliminated the possibility of a virus, matching the findings of the National Wildlife Health Center, with whom I am working closely. The vitamin E and selenium level analyses of heron tissues have been started, but are not yet finished. Potential immune-system suppression by organic contaminants (DDE and PCBs), high in Southern California (Henny et al. 1984, Ohlendorf and Marois 1990), will be investigated with this analysis. Along with tissue analysis for PCBs and all DDT compounds, a general scan for other organochlorine pollutants will be conducted. In addition, tissues will be analyzed for 13 elements shown by other researchers in the laboratory to induce steatitis: (selenium (Se), silver (AG), zinc (Zn), cadmium (Cd), tellurium (Te), cobalt (Co), copper (Cu), mercury (Hg), tin (Sn), lead (Pb), iron (Fe), arsenic (As), and sulfur (S). This information is necessary before steatitis can be potentially corrected or controlled. Monitoring and behavior observations must continue along with the banding and tagging program. All of this information will be crucial to solving the puzzle of this disease and helping to provide a health environment for herons and humans.

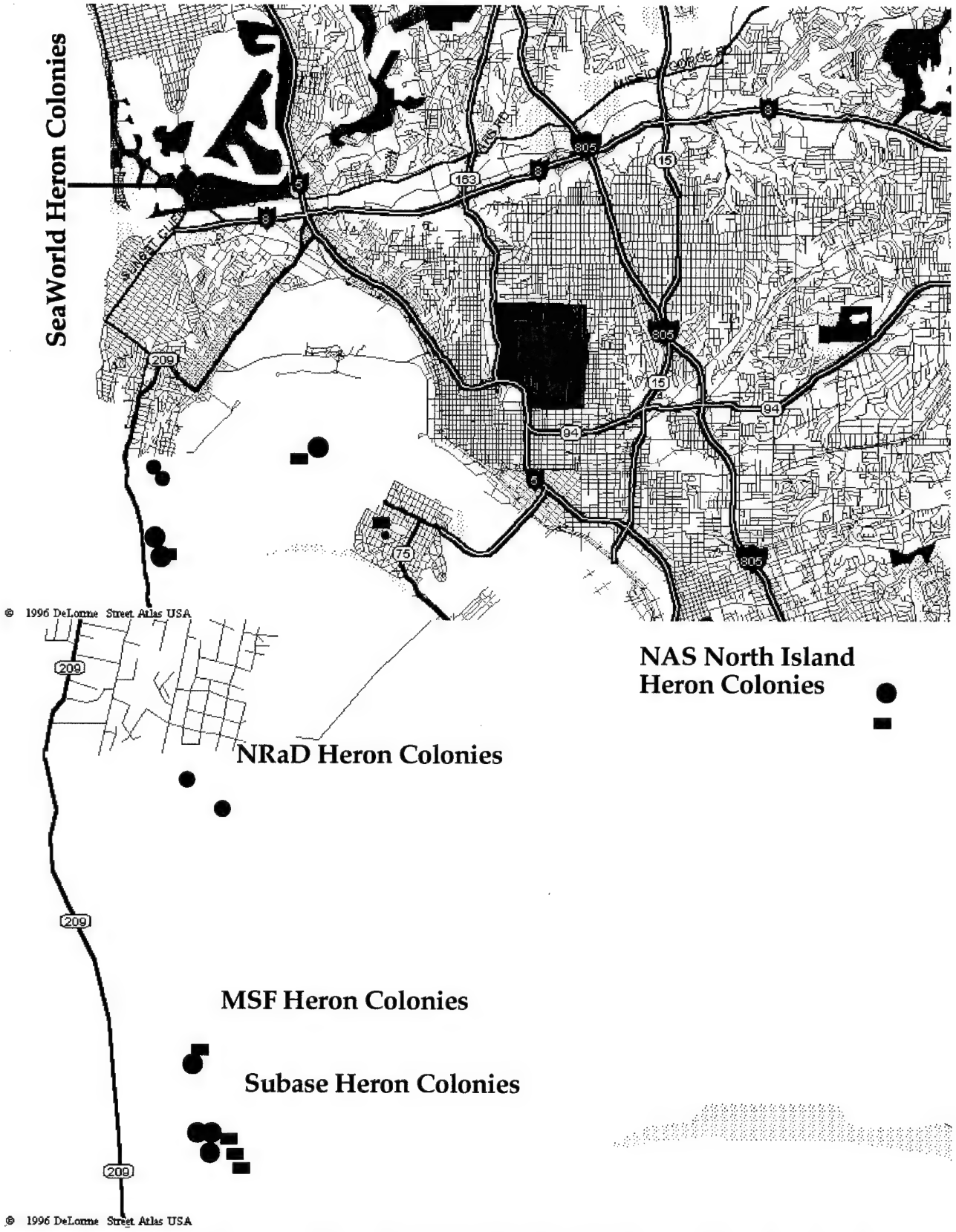


Figure 1 on top is an overview map of the major San Diego heron nesting areas; **figure 2** is a closeup of heron colony locations. Blue circles=great blue herons; black squares=black-crowned night herons.

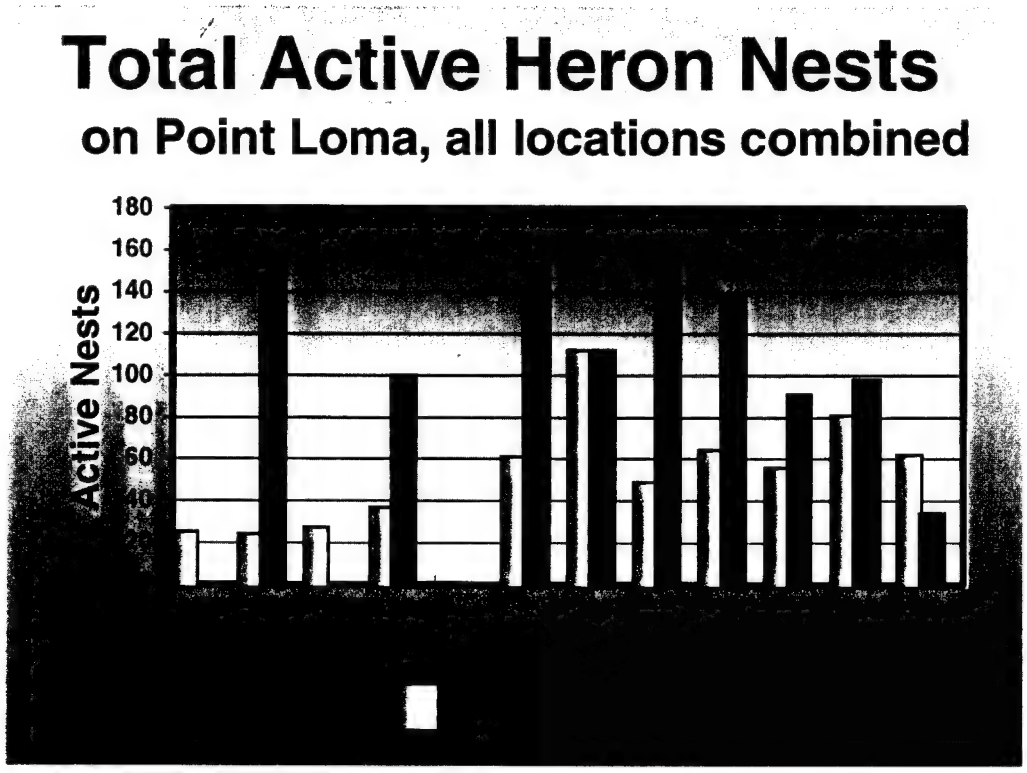
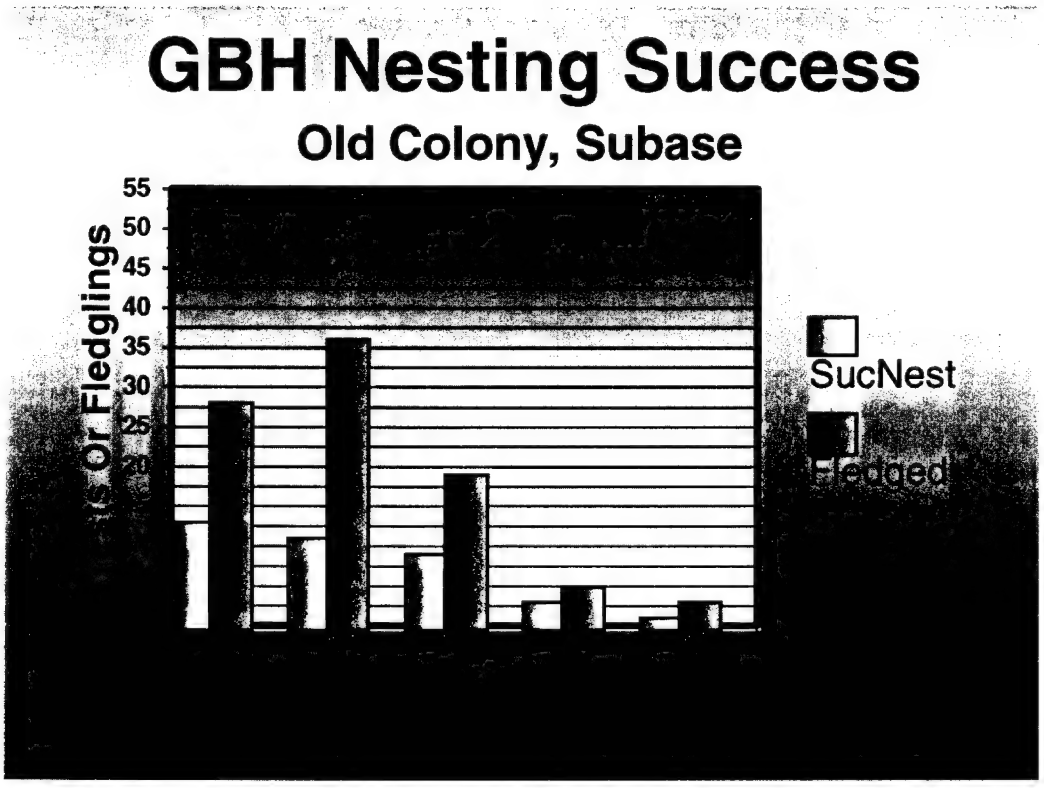


Figure 3. Black-crowned night herons were nesting on Point Loma from about 1970 on; unfortunately the data are scanty. From 1990 onward, the black-crowned night heron breeding population is steadily declining from unknown reasons. The great blue herons have increased somewhat from 1980, and appear to be stable. If steatitis continues to be a problem, they may also start to decline.

Figure 4. The current Old Colony is a fragment of the former colony. It was mostly destroyed in 1980 to construct an entry road for the Steamplant. The nesting limbs are mostly dead from eucalyptus beetles, and the area in back of the trees is the favorite dumping ground of unwanted dirt, leading to disturbance in the last two years during January, the most sensitive time of the breeding season.



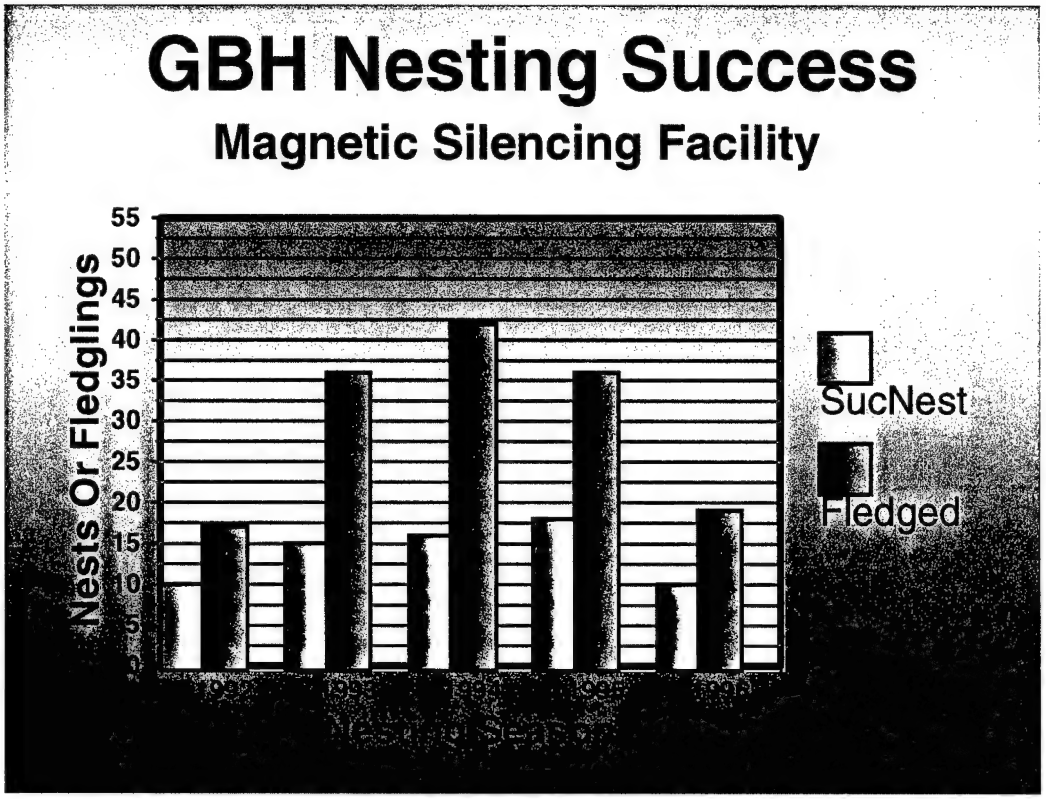


Figure 5. The large eucalyptus trees east of the generator building at the Magnetic Silencing Facility Pier has provided a stable area for nesting great blue herons. For the first time in 1996, four pairs of black-crowned night herons also nested in these trees.

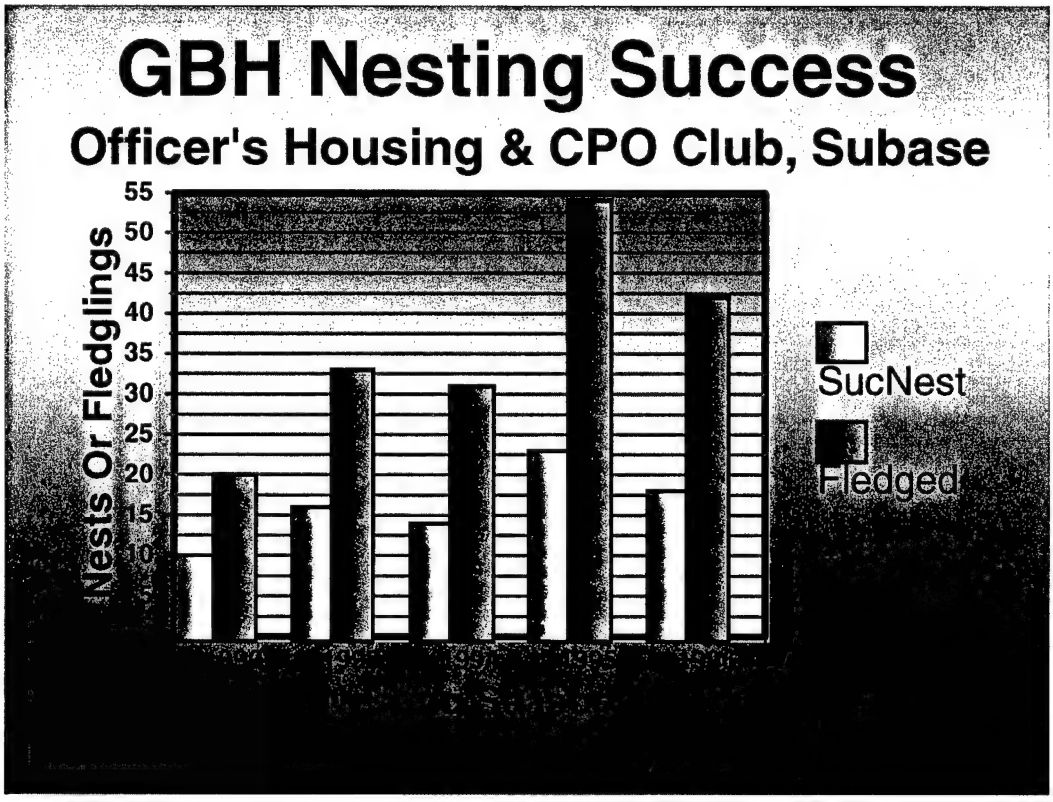


Figure 6. The large eucalyptus trees near the Admiral's house, and near the former CPO Club have provided stable nesting areas for first black-crowned night herons, then starting sometime after 1980, for great blue herons. In 1996, similiar to MSF, black-crowned night heron pairs had returned to this area.

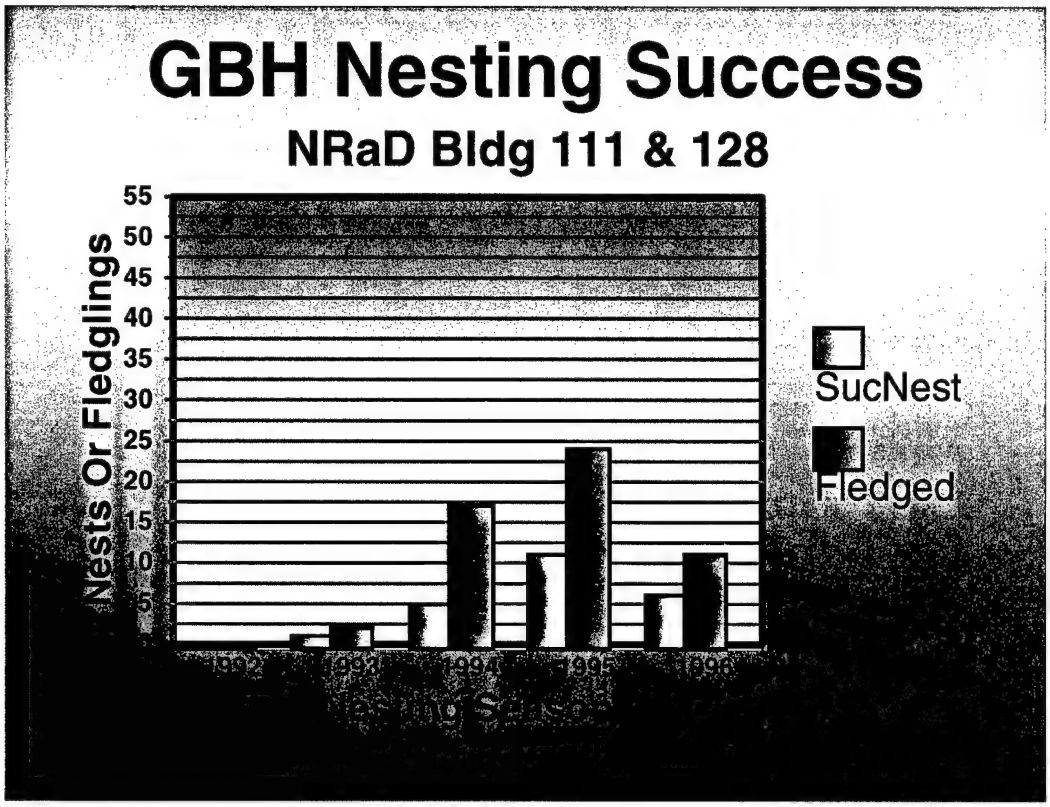


Figure 7. The large Torrey pine trees around NraD Buildings 111 and 128 are, begining in 1993, now part of the Point Loma meta-colony. Only time will tell if they will support more nests, or if the herons will move on in a few years.

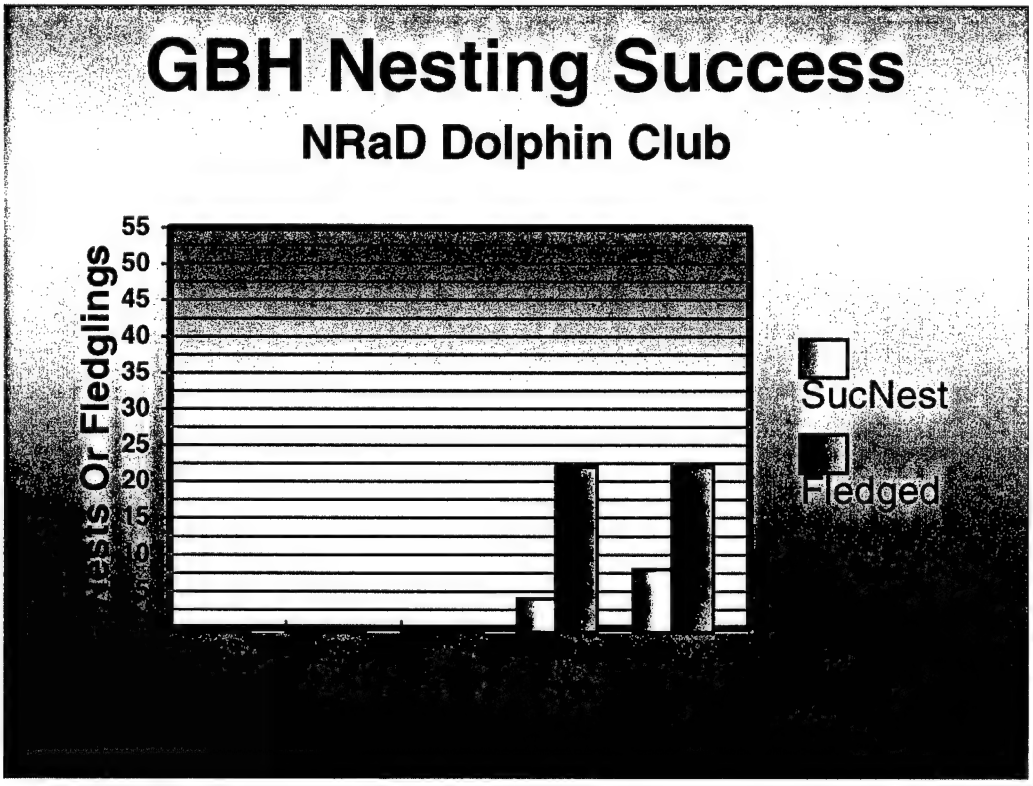


Figure 8. A row of large, old eucalyptus trees northeast of the Dolphin Club, NRaD, have supported great blue heron nests since 1995. During both years, fifty percent or more of the late nest s have failed due to steatitis. In 1996, four late nests lost at least two known chicks to severe steatitis.

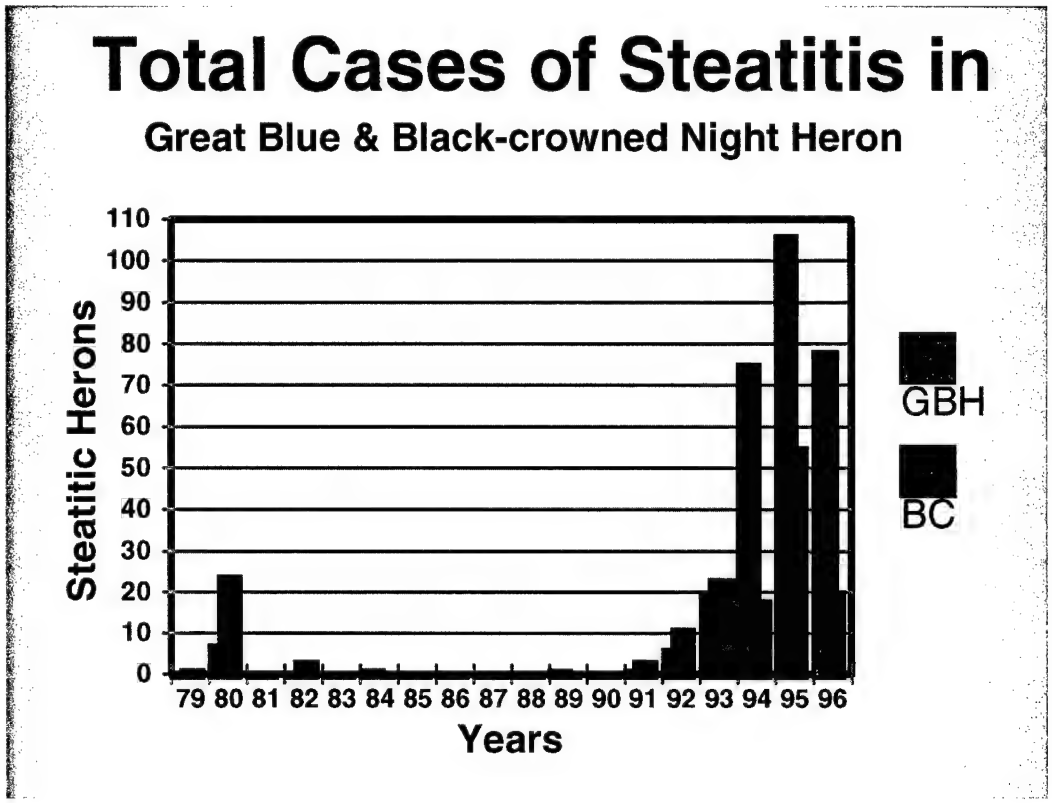


Figure 9. Steatitis or yellow fat disease, made a short appearance during 1980, then returned starting in 1991. It has been an epidemic since then, with the greatest losses occuring amoung great blue herons. The causes are unknown to date, other than the fact that it is mostl likely a dietary problem.

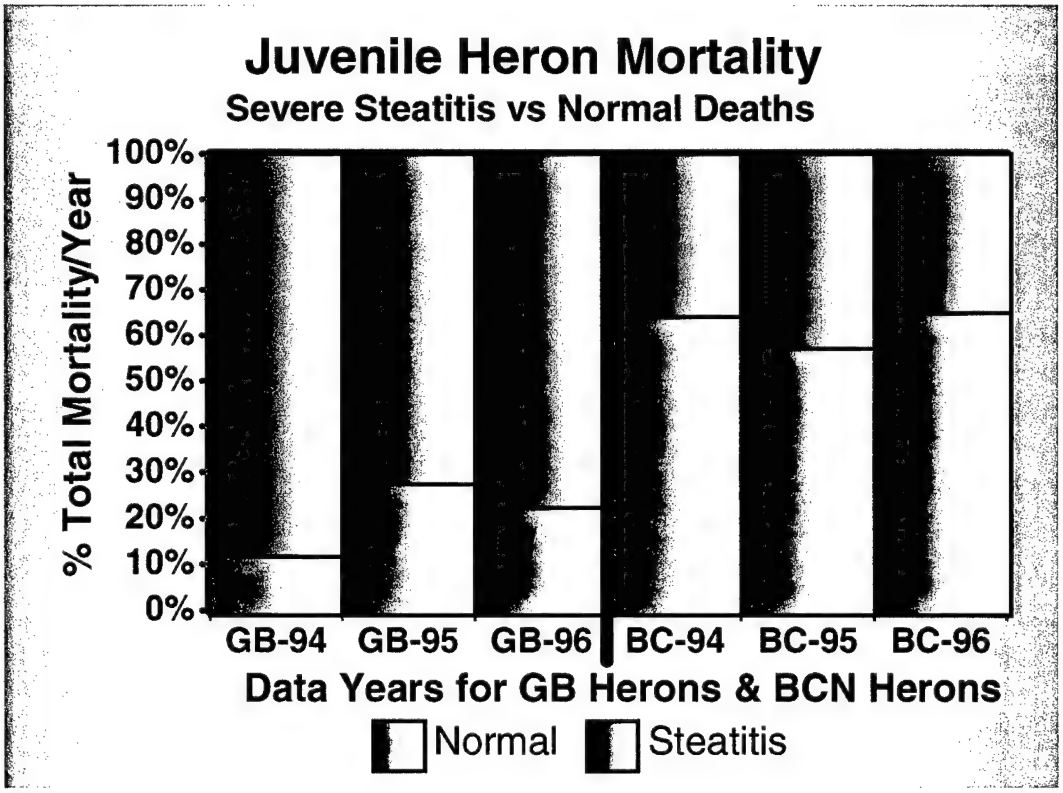


Figure 10. This figure shows clearly that great blue heron juveniles (one year old and less) are much more susceptible to steatitis than are similar black-crowned night heron juveniles.

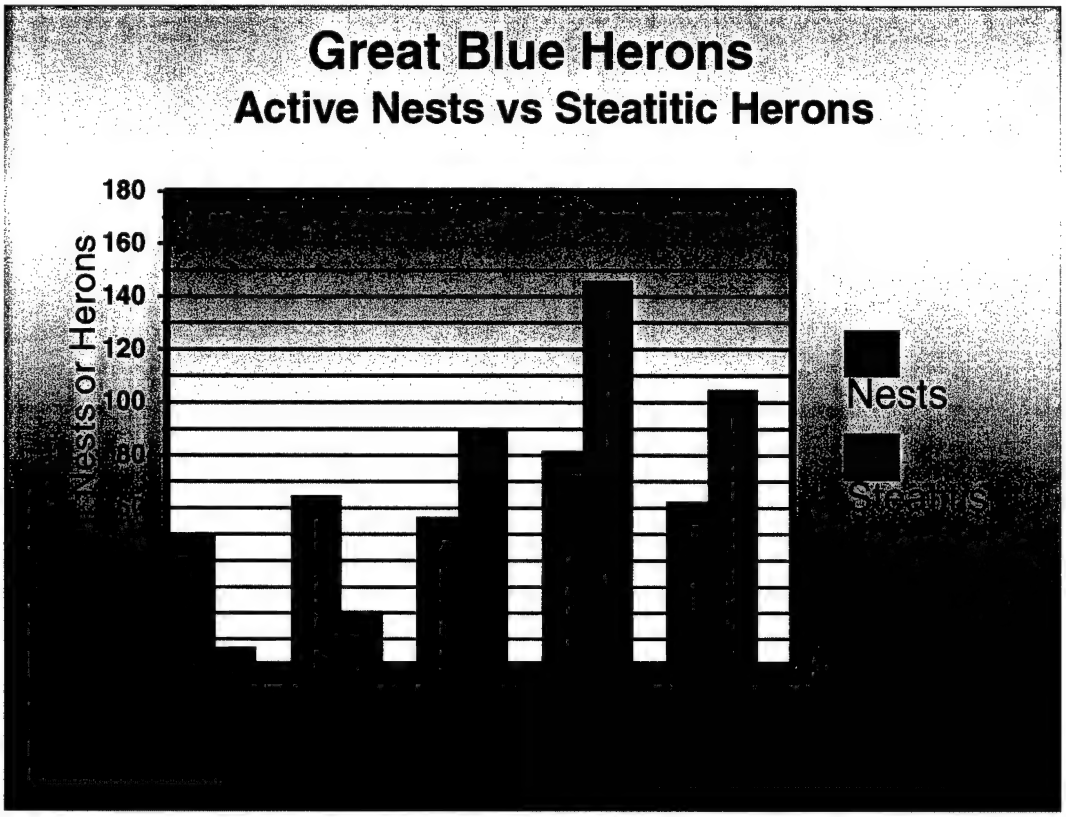


Figure 11. During 1994, 1995, and 1996, the pattern of steatitic cases and the number of active nests tend to match for great blue herons. This pattern tends to suggest that a certain percentage of the entire population is doing an unknown something in common that puts them at risk of contacting steatitis.

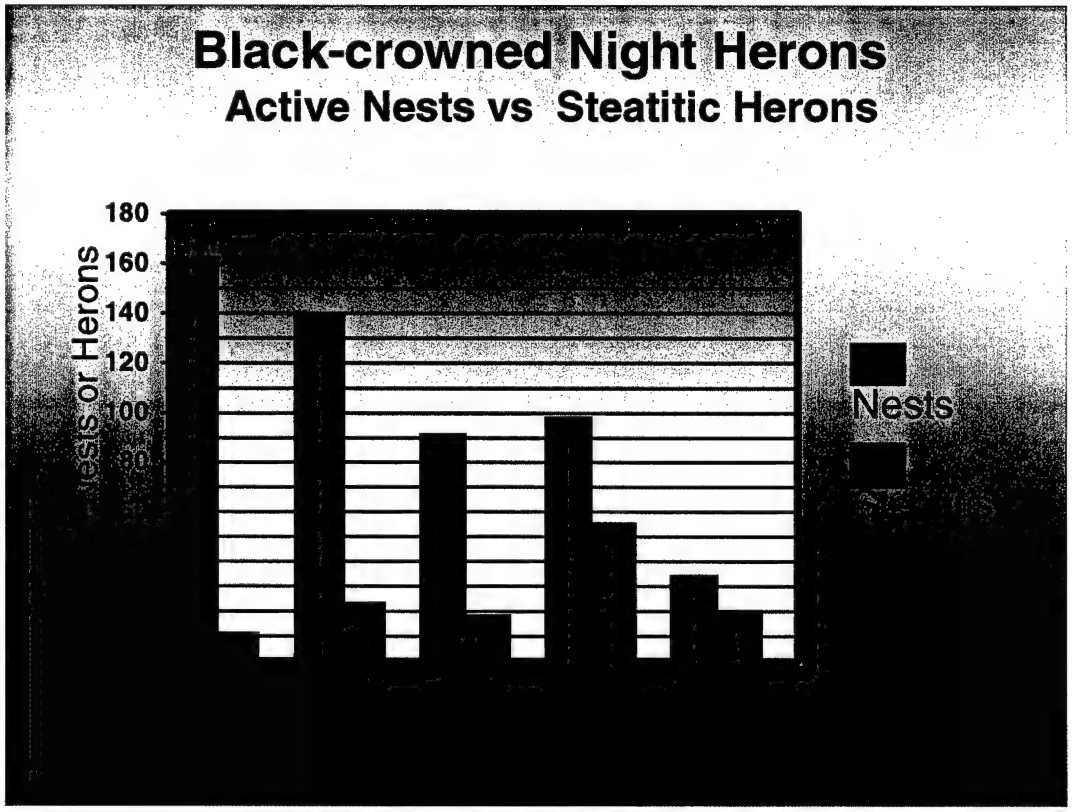


Figure 12. Black-crowned night herons show a steady decline in active nests. This pattern has little in common with the pattern of steatitis cases. Some other, unknown factor is causing their decline, although steatitis may well be assisting in lowering the population.

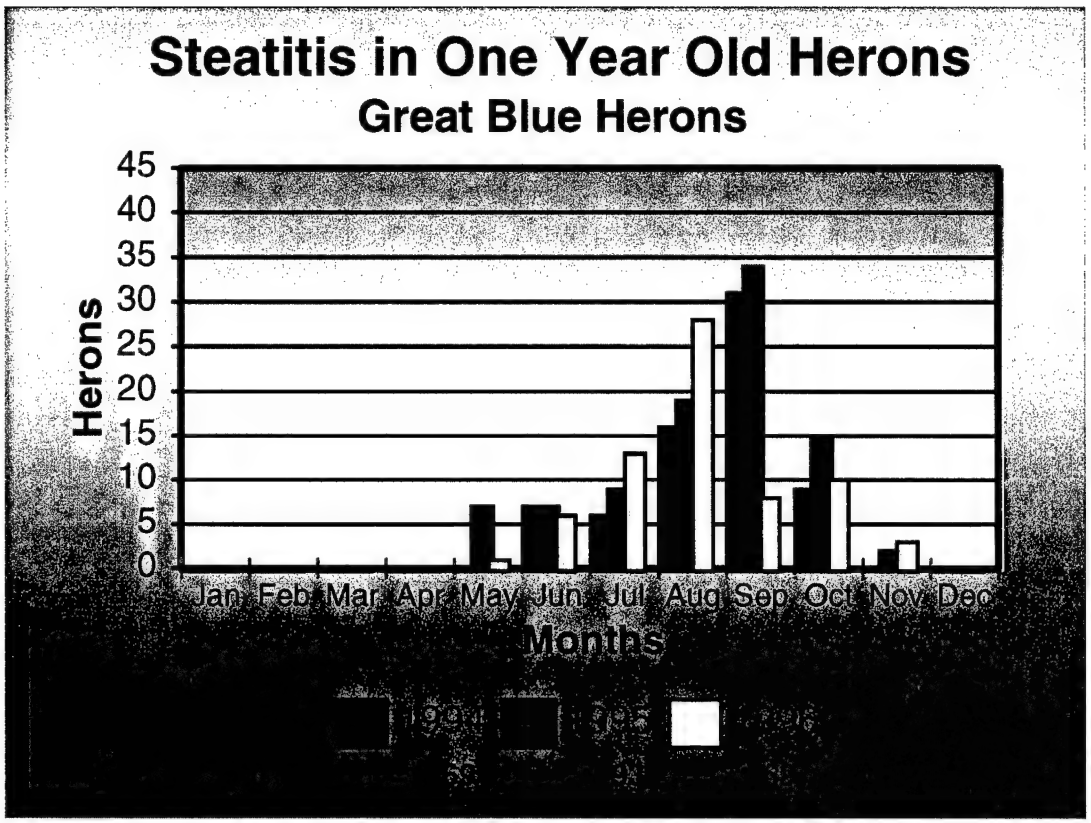


Figure 13. Steatitis occurs most frequently in herons under one year of age. For great blue herons, the months they are mostly like to be found with steatitis are August and September; only in the last two years have herons been found with steatitis in May and November.

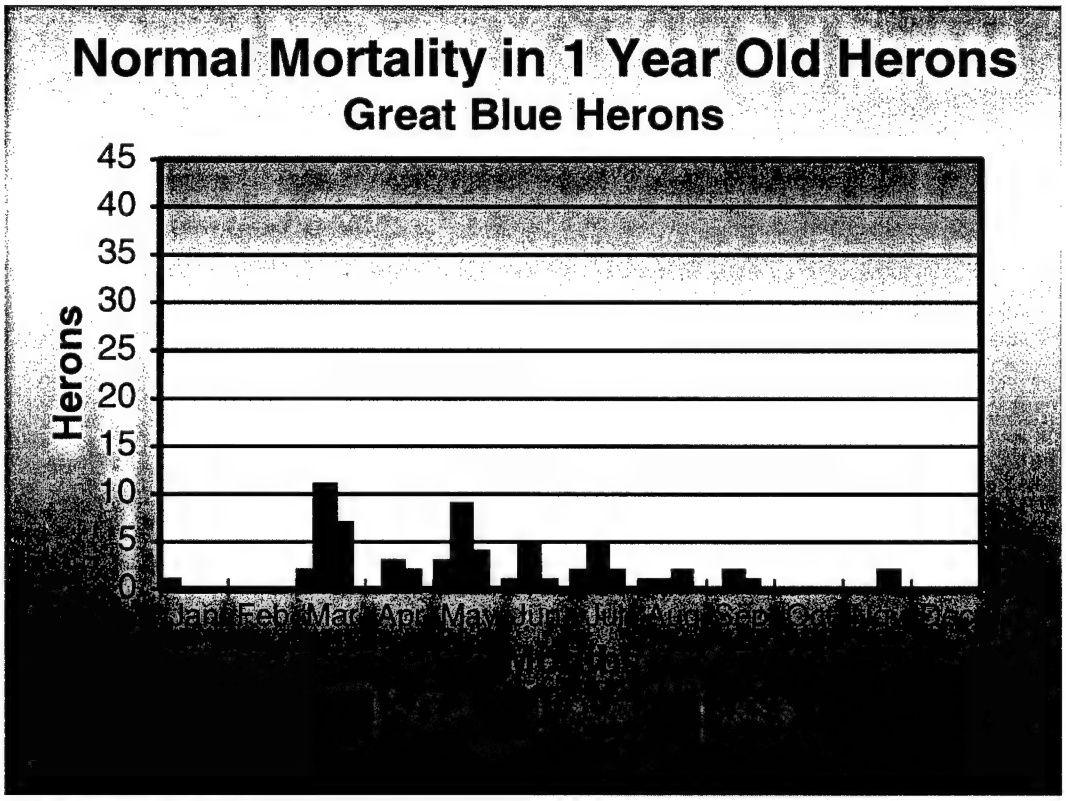


Figure 14. Normal causes of mortality definitely affect young herons and tends to concentrate during the chick and young fledging stage during the breeding season. But their greatest effect is lessened by growing simply by maturing.

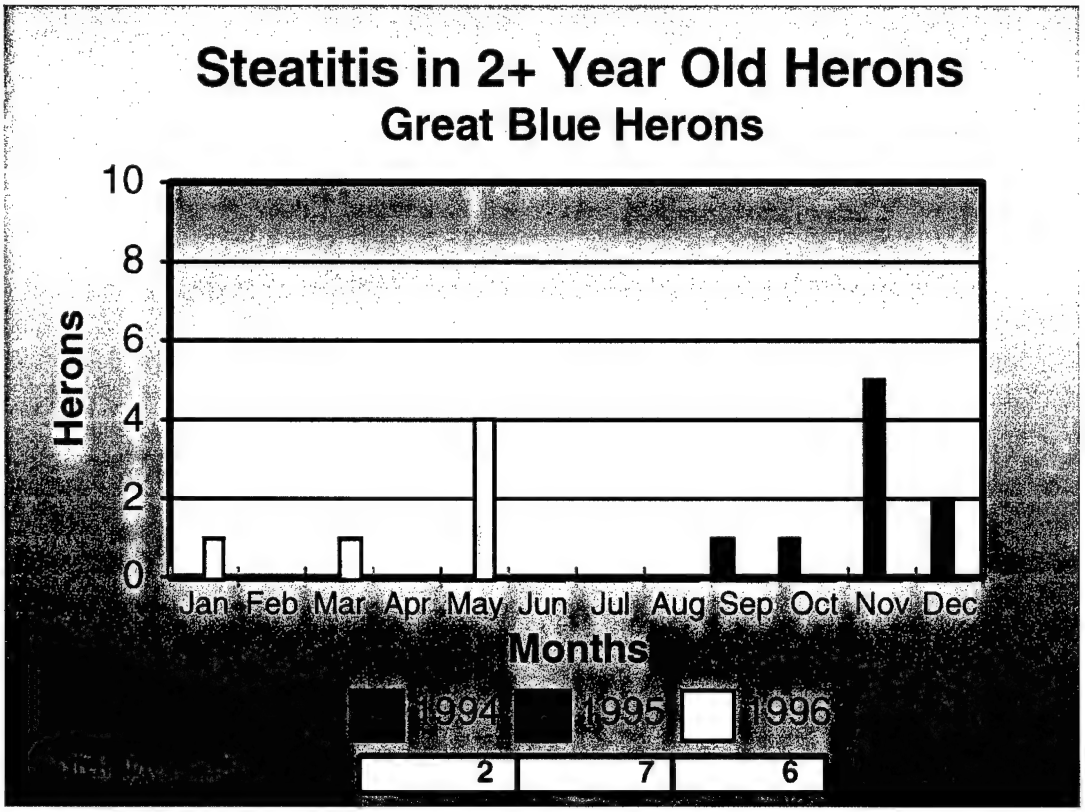


Figure 15. Steatitis occurs lightly in subadult and adult great blue herons. I suspect the very early cases during 1996 were in reality very late cases lingering from 1995, which was a terrible year for steatitis. Full adults with severe steatitis were found for the first time in 1995.

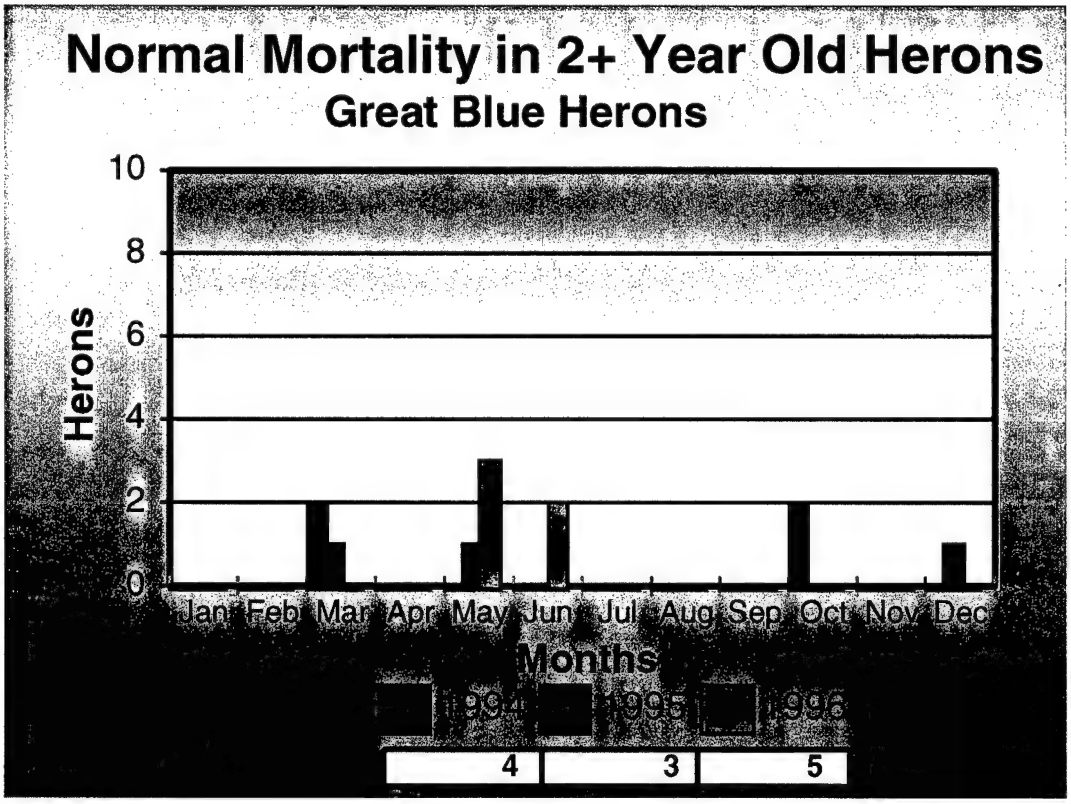


Figure 16. Normal causes of mortality for subadult and adult great blue herons, such as broken bones, or sickness, occur fairly randomly and at a low level throughout the year.

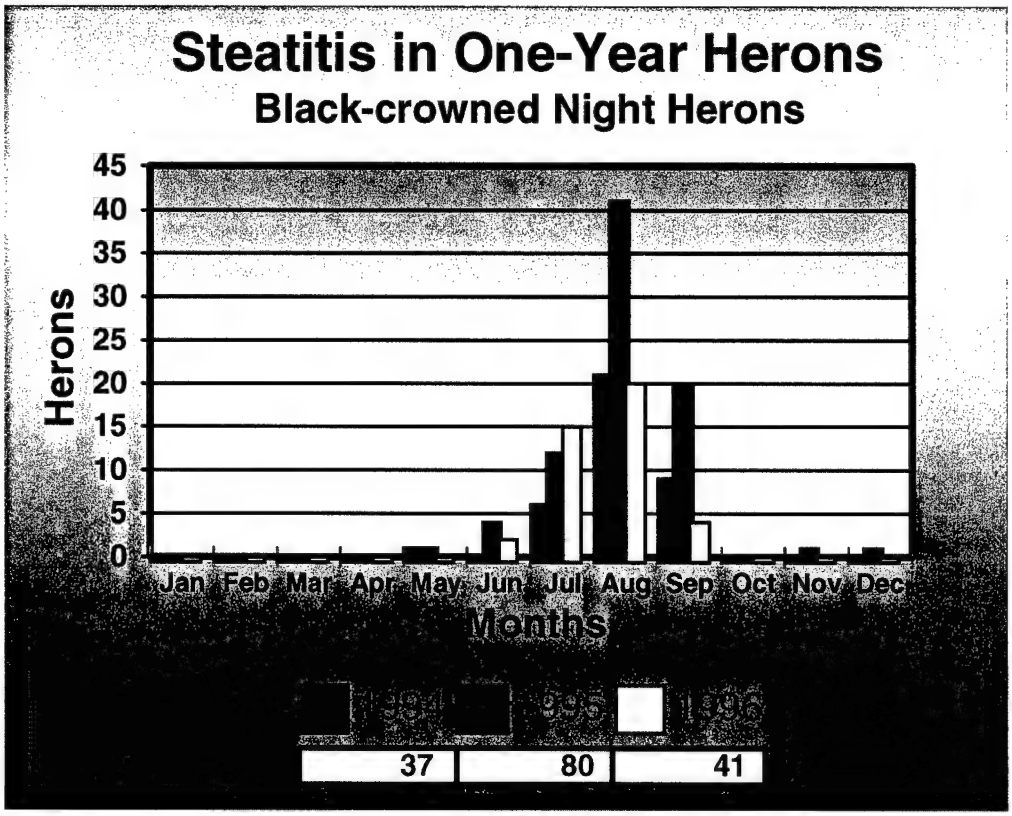


Figure 17. Steatitis occurs most heavily in the young black-crowned night herons, as compared to subadult and adult herons. This pattern is also seen for normal causes of mortality. However, steatitic mortality, which is also associated with the hazardous stage of sub-fledging, mostly occurs at the end of the breeding season (July, August, September).

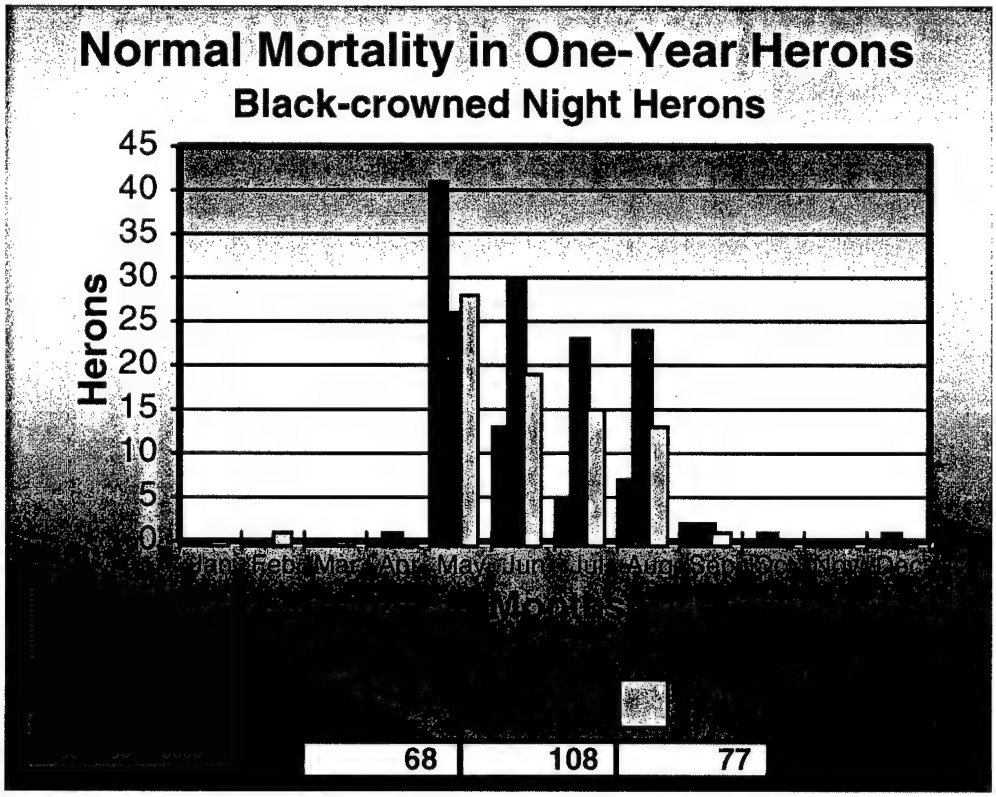


Figure 18. Young black-crowned night herons suffer many accidents in their first year of life, in addition to the negative effects (such as being pushed out of the nest too early or starved) of sibling rivalry. The pattern of normal mortality tends to be highest in the early stages of hatching and fledging (May and June).

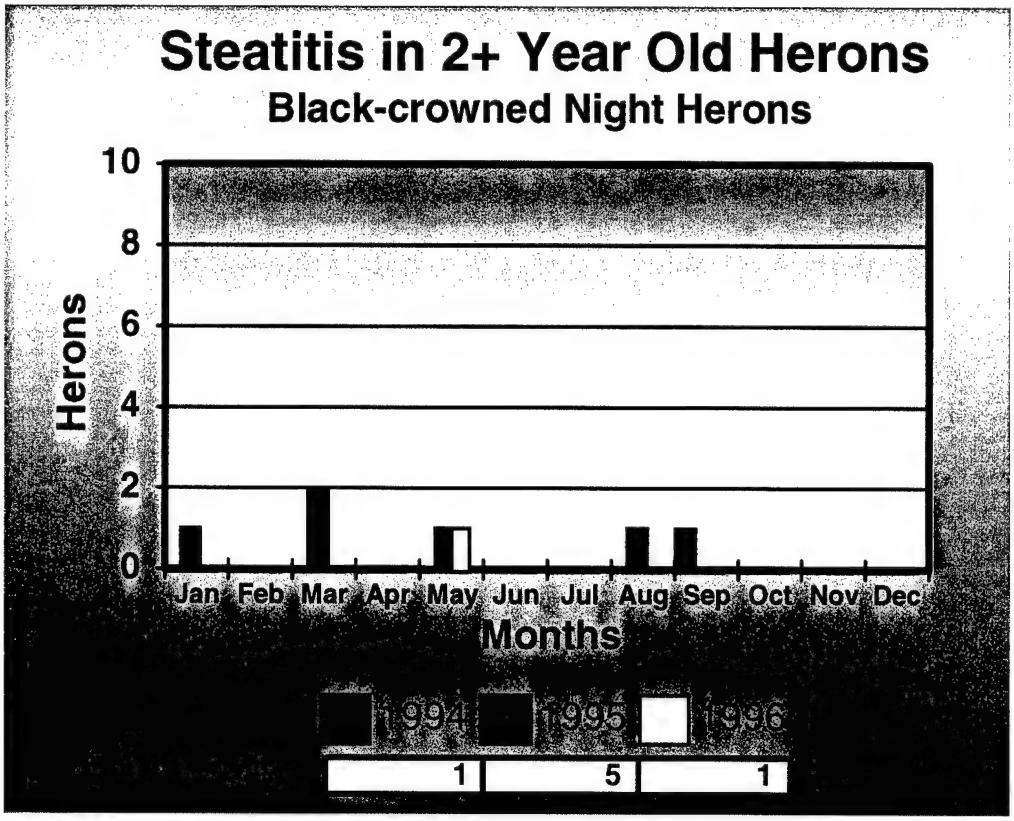
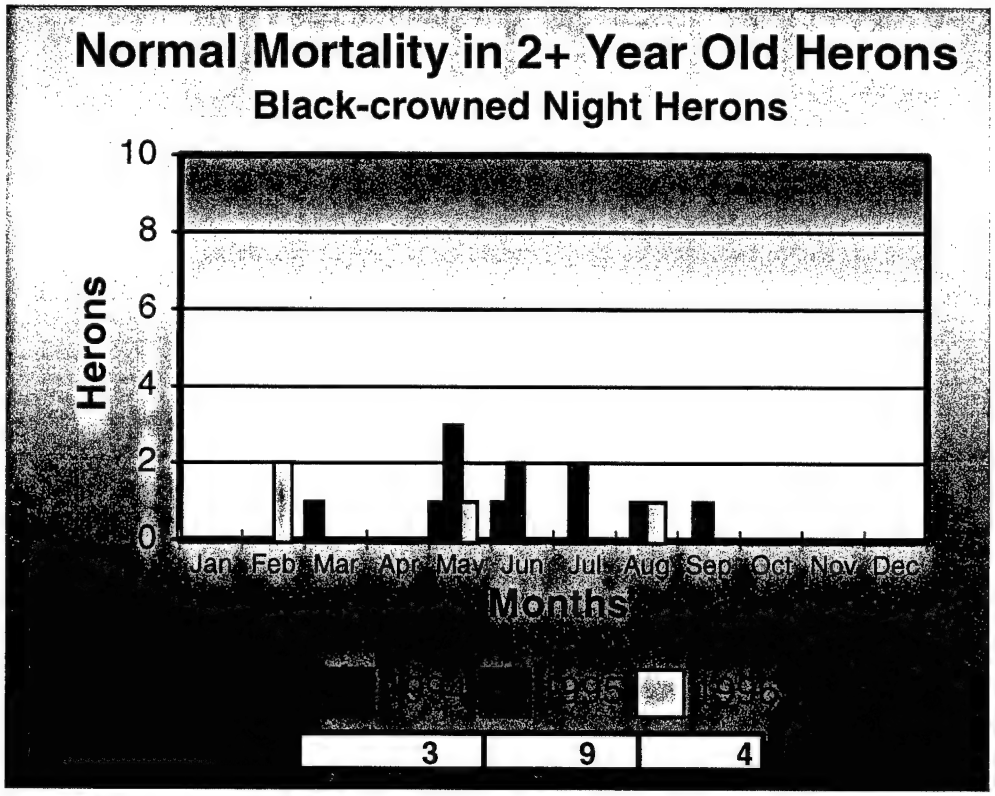


Figure 19. Steatitis does occur in subadult and adult black-crowned night herons, but at a much lower level and it is more randomly spaced throughout the year.

Figure 20. Normal causes of mortality (non-steatitic) such as sickness, starvation, trauma (including broken bones) occur for subadult and adult black-crowned night herons throughout the year. A slight clustering effect appears to hppen during the height of the breeding season.



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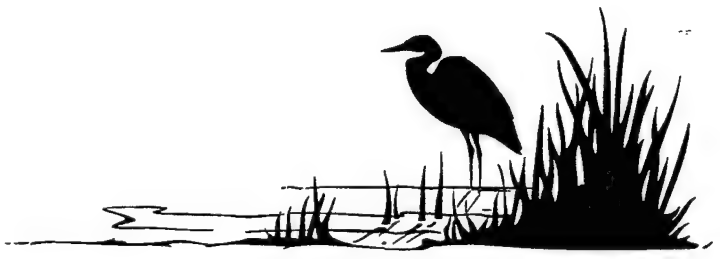
Appendix K- Heron Management Plan for Naval Submarine Base San Diego, 1995

HERON MANAGEMENT PLAN

FOR

NAVAL SUBMARINE BASE SAN DIEGO



prepared by

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SEPTEMBER 1995

HERON MANAGEMENT PLAN

FOR

NAVAL SUBMARINE BASE SAN DIEGO

(Subase)

Point Loma, San Diego, California

prepared for

NRaD

NAVAL COMMAND, CONTROL and OCEAN

SURVEILLANCE CENTER

RDT&E DIVISION

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September 1995

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EXECUTIVE SUMMARY

Nesting colonies of Great Blue Herons and Black-crowned Night Herons on the Naval Submarine Base San Diego and other Department of Defense lands on Point Loma are a significant local and regional natural resource. The birds and their nesting, roosting, and foraging habitat are protected by a variety of federal, state, and local laws, regulations, and policies. In addition, the colonies are considered to be of high interest and value by scientists, conservationists, the general public, and the Navy. For these reasons, proper and considerate long-term management of the birds' habitat is an appropriate and important goal for the responsible Naval Commands.

At present, the nesting colonies affect base operations mostly from the standpoint of sanitation, especially bird droppings in parking areas. The colonies also constrain some development, and some routine maintenance, but few other operations. In general, the herons nesting on Point Loma have adapted to much human disturbance such as noise, traffic, and human proximity, that would likely deter colonization at other localities. Nevertheless, a variety of potential threats and hazards to the viability of the colonies exist. Habitat alteration and the potential effects of pollution are the principal concerns. Without careful stewardship and monitoring, the colonies could experience catastrophic declines or desertions.

The increased incidence during the last few years of the typically fatal yellow fat disease in herons nesting on the base is also a serious concern. The source of the disease is still unknown but could be related to dietary factors resulting from contamination caused by commercial, recreational, or Naval activities on or around San Diego Bay. Studies are currently in progress, and others are planned, to investigate and address this issue.

Appropriate long-term management for the well-being and stability of the nesting colonies and other key heron habitats can likely be achieved with minimal disruption to essential

Naval activities, but will require a heightened of awareness and attention by a wide variety of planning and operational groups within Subase and adjacent facilities. Sustained support from the highest command levels will be required to achieve and maintain the communication and coordination necessary for the success of this conservation effort.

Specific actions needed to preserve the heron colonies will include a focus on maintaining and creating suitable nesting and roosting habitat, and protecting these and nearby foraging areas from significant disturbance and contamination. Ongoing monitoring of the birds, their condition and reproductive success, and the quality of their habitat and food resources will provide the only means to gauge the success of a comprehensive conservation program.

With sufficient time, planning, and coordination, the vast majority of problems currently generated by the birds can likely be eliminated with relatively little cost or inconvenience. Their solution should be considered not only proper stewardship of natural resources on public lands but also as occasion to provide the human occupants of the bases and the local community with a unique educational and recreational opportunity.

INTRODUCTION AND OBJECTIVES

The Naval Submarine Base on Point Loma, California, is the site of a large breeding colony of Great Blue Herons (*Ardea herodias*) and Black-crowned Night Herons (*Nycticorax nycticorax)*. These species have been identified as sensitive resources warranting special consideration in numerous environmental documents addressing the Naval Submarine Base and other government facilities on Point Loma (*e.g.*, Platter-Rieger 1981, Woodward-Clyde 1981, Wright 1982, Wagoner 1989, Platter-Rieger 1991, GPRO 1993, Wisniewski 1994, Southwest Division 1993). These documents contain extensive descriptions and inventories of Point Loma's natural resources, and serve as primary background references. Wright (1982) prepared a Habitat Enhancement Plan for Great Blue Herons on Point Loma, but the Natural Resources Management Plan for the Naval Submarine Base (Wagoner 1989) additionally recommended the creation and implementation of a formal management plan for the herons on the Subase. The objective of this plan is to provide information and guidance for the long-term protection, conservation and management of the Great Blue Heron and Black-crowned Night Heron populations on the Subase and nearby military installations.

The Naval Subase is situated on Point Loma, a prominent peninsula sheltering San Diego Bay from the Pacific Ocean (Figures 1 and 2). The site is developed with work and parking areas, and buildings for administration, housing, training, storage, and support of naval operations. Much of the remaining undeveloped areas have use or building restrictions due to activities associated with the submarine piers, the Magnetic Silencing Facility (NAVSTA-MSF), and the Point Loma Wildlands Reserve. Explosive Safety Quantity Distances (SQD) arcs associated with torpedo activities, Electromagnetic Interference Free (EMI) zones, and Wildlands Reserve Boundaries are some of the constraints on land use and development. The remaining native habitats include mixed chaparral, maritime sage scrub, and grassland (Southwest Division 1993).

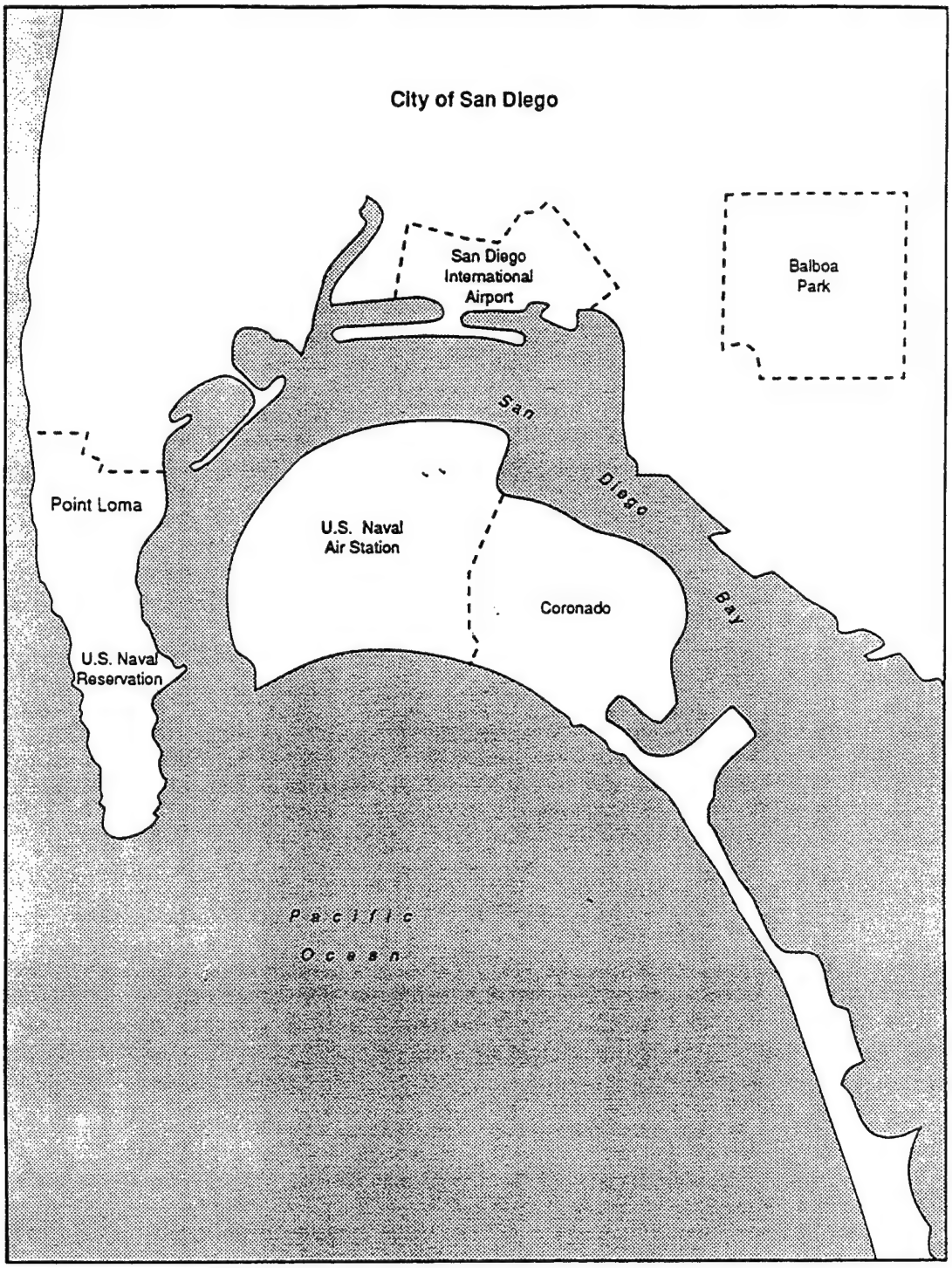

Figure 1. City of San Diego and San Diego Bay, showing general position of Point Loma.
(Source: Advanced Sciences, Inc. 1993)

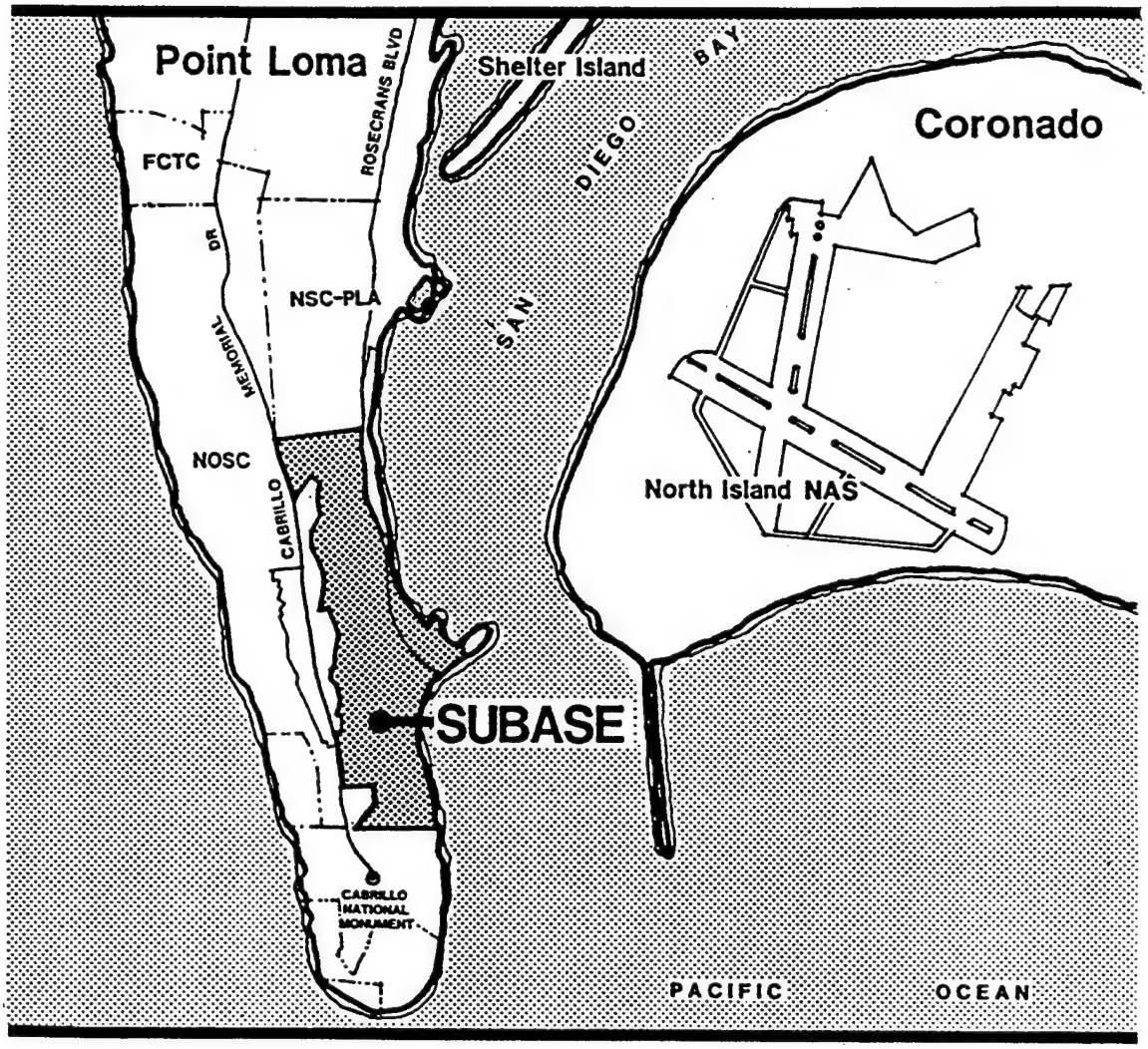

Figure 2. Detail of Point Loma showing extent of SUBASE property.

METHODS

Information used to prepare this plan was derived from a wide variety of sources, including a review of all available pertinent literature, visits to the site by the preparers of the plan, examination of museum specimens and data, and discussions with knowledgeable individuals both on the site and at various governmental and academic institutions.

SYNOPSIS OF LIFE HISTORIES

GREAT BLUE HERON

The Great Blue Heron is the largest heron in North America (60 cm tall, 97-137 cm long). This species has an extremely wide range and has adapted to a wide variety of habitats and circumstances. It occurs in both freshwater and saltwater environments and forages both by night and by day. Although the diet of this species consists primarily of fish and other aquatic organisms, it eats a diverse range of animals including mammals, reptiles, amphibians, invertebrates, and birds. These herons generally forage for fish by wading near shore; however, they also often hunt from floating objects. They may roost alone or in flocks, on the ground, in trees, or on man-made objects. Butler (1992) reviewed of all aspects of the species' life history.

Like most herons, Great Blues nest mostly in colonies. Located in a variety of situations, these colonies are always near water and sometimes consist of hundreds of nesting pairs. Being large and conspicuous, Great Blue Herons are vulnerable to disturbance by humans and a variety of non-human predators. Although they are considered migratory birds, little is known about their dispersal and movements. Great Blue Herons exhibit elaborate behavioral displays involved in courtship and territorial defense. Much of the daily life of Great Blue Herons is spent in preening and other self maintenance activities. The birds build large stick nests that they often

use from year to year and refurbish throughout the breeding season.

BLACK-CROWNED NIGHT HERON

The Black-crowned Night Heron is a medium-size heron (38-45 cm tall and 58-66 cm long). It also has an extremely large range, occurring on all continents except Australia and Antarctica. Davis (1993) provides a comprehensive review of the life history of this species, from which much of the information contained here is derived. Black-crowned Night Herons occur in fresh, brackish, or salt water environments. They forage primarily from evening to early morning but also feed during the day during the breeding season and at times of high food demand. Although this species eats primarily fish, it too feeds opportunistically, with a diverse diet including reptiles, amphibians, invertebrates, birds, plant materials, and refuse at landfills. Declines in Black-crowned Night Heron numbers have been attributed to hunting, drainage of wetlands, disturbance at breeding colonies, and loss of habitat due to land development. The factors regulating population size appear to be primarily habitat alteration and food availability. Predation on eggs and nestlings by raccoons, muskrats, Great Horned Owls, Ring-billed Gulls, Common Crows, and jays has been reported. Predation and severe spring storms are important factors affecting nesting success.

Black-crowned Night Heron breeding colonies may last 30 to 50 years or more, although they may relocate if disturbed. A large variety of nest substrates, including oaks, willows, cattails, salt cedar and poison ivy have been reported. Nests may be built of twigs or reed-like leaves, and old nests are often reused. Clutch size is usually 3 to 5 with a mean of approximately 3.6 eggs per nest. Mortality of first year birds is approximately 61%, while annual adult mortality is about 31%. Recoveries of banded birds 15-21 years old has been reported. Two to 2.1 young per pair over the course of the birds lifetime has been suggested as a minimum reproductive success level necessary to maintain a stable population. Black-crowned Night Herons typically roost away from the colony once the young have fledged.

STATUS OF POINT LOMA HERON NESTING COLONIES

Both Great Blue and Black-crowned Night Herons have undoubtedly been common inhabitants of the San Diego Bay area for centuries. Although few specific data are available, it is reasonable to assume that nest sites for both species were historically limited to either native trees or inaccessible cliff faces. The introduction of eucalyptus (*Eucalyptus* sp.) and other trees (Wisniewski 1994) during early years of construction on the Point Loma military facilities provided the opportunity for establishment of the Great Blue Heron and Black-crowned Night Heron breeding colonies.

GREAT BLUE HERON

Historical Status

Early publications on the birds of San Diego County report this species as "Present through the year in small numbers" (Stephens 1919), and "Common resident west of the desert. Occurs around all suitable bodies of water, fresh or salt. Breeding colonies formerly many, now apparently few" (Sams and Stott 1959). Neither publication made specific reference to nesting in the vicinity of Point Loma. Unitt (1984) summarized the historical status of the species in the County, noting a decline in known nesting localities and reporting the first observations from Point Loma of 13-15 active nests in 1972. Other apparently sporadically occupied colony or single nest sites were reported by Unitt at Lake Henshaw, Sutherland Reservoir, Del Mar, and Crown Point.

Recent Status

Between 1977 and 1981, and from 1990 to the present, records on nest location,

reproductive effort, and breeding success at Point Loma have been collected and maintained by Mary F. Platter-Rieger (Platter-Rieger 1981, 1991, pers. comm.). These data indicate a fairly consistent increase in nesting pairs throughout the period, from a low of 24 pairs in 1977.

Colony Significance in Local Context

The Point Loma nesting colony is one of only six known currently active breeding sites for this species in San Diego County, and is apparently the largest of the six. The other five are located at Sea World on Mission Bay, Naval Air Station North Island, in Carslbad at the corner of Highland Avenue and Chestnut Drive, and at the long-occupied sites near Lake Henshaw and in Rancho Santa Fe near the Whispering Palms golf course. Development, disturbance, and deforestation of riparian corridors have likely been the causes of abandonment of other historic sites (Unitt 1984).

Considering this, it is apparent that the nesting colonies on Point Loma likely have an important role in sustaining local populations of this species.

Colony Significance in Regional Context

Relatively few nesting colonies of Great Blue Herons are known in southern California. Those reported include the San Diego sites noted above, the Salton Sea and Colorado River in Imperial County, Irvine Lake and Coalmine Lake in Orange County, Lake Casitas in Ventura County, Goleta and Lake Cachuma in Santa Barbara County, and Morro Bay in San Luis Obispo County (Garrett and Dunn 1981). It is likely that other colonies exist but have not been reported. However, any unreported colonies are either not very large or are sporadically occupied.

The California Department of Fish and Game (CDF&G) conducted several state-wide inventories of heron rookeries between 1969 and 1978 (Belluomini 1978). Over that time, according to this report, known nesting sites increased but the total population decreased.

Throughout California, known nesting colonies are so few and vulnerable to disturbance that the California Department of Fish and Game (1991) has designated their heronries under its Bird Species of Special Concern List. Elsewhere in North America, there is no dramatic evidence of population declines, but, like other large, conspicuous predators, Great Blue Herons are believed to be good indicators of habitat quality and therefore important to conserve and monitor (Butler 1992).

BLACK-CROWNED NIGHT HERON

Historical Status

Like the Great Blue Heron, the Black-crowned Night Heron has long been a common bird of the coastal wetlands. The earliest review of their status in San Diego County (Stephens, 1919) describes the species as a "Common migrant, rare summer resident. More common in winter." Sams and Stott (1959) noted that the species was "A common resident, to be seen everywhere... A large breeding colony in the center of Balboa Park." Egg records from the Western Foundation of Vertebrate Zoology reflect nesting in 1934 and 1935 at "Sorrento".

Recent Status

Unitt (1984) summarized unpublished information, listing known San Diego County breeding colonies at Buena Vista Lagoon, near Old Mission Dam, North Island Naval Air Station, in Coronado at Library and Spreckels Park, and in Imperial Beach. He also provided the first data on the Point Loma colony, noting 157 pairs counted on 24 March 1978. Certainly other unreported colonies have been active for years, such as those at Scripps Institution of Oceanography, Naval Training Center, NCCOSC, and at the San Diego Naval Station at 32nd Street (W.T. Everett, pers. obs. 1995, M.F. Platter-Rieger, pers. comm.).

Platter-Rieger (1991) estimated 100 active nests on Point Loma in 1980, 166 nests in

1990, and 112 nests in 1991. Records of heron nesting activity from 1992 to the present are archived in the files of Mary Platter-Rieger (pers. comm.).

Colony Significance in Local Context

Clearly, the Point Loma Black-crowned Night Heron colonies are the largest in San Diego County. Although this species seems more adaptable in its choice of nesting sites than the Great Blue Heron, it is nevertheless vulnerable to a variety of perturbations (see below). The continued existence and well-being of the Point Loma colonies undoubtedly plays a major role in the currently healthy local populations of this species.

Colony Significance in Regional Context

As noted in the life history summarized above, the Black-crowned Night Heron is nearly cosmopolitan. In North American, the species appears to be stable or increasing (Davis 1993), despite some evidence that suggests contaminants have adversely affected certain local populations. Surprisingly, the CDF&G California inventory data for 1969-1978 (Belluomini 1978) indicate that there are (or were) fewer known nesting sites and nests for this species than for the Great Blue Heron, and that both the overall population numbers and number of active nests declined during that period. This decline was also noted by Garrett and Dunn (1981). There appear to be no more recent data to determine whether this trend has continued. Regardless, it is clear that the Point Loma colonies are very significant from a regional perspective.

MANAGEMENT FRAMEWORK

A wide variety of Federal and State laws, Executive Orders, Department of Defense Directives and Instructions are relevant to management and preservation of the Point Loma heron colonies, or otherwise constrain activities that could adversely affect their well-being. In

addition, wise stewardship of natural resources was identified as a key element in the Point Loma Complex Community Relations Plan for the Installation Restoration Program & Environmental Enhancement Projects (GPRO 1993).

A detailed review of all pertinent rules and regulations relative to natural and cultural resource protection and management can be found in the Natural Resource Management Plan, Naval Submarine Base, Point Loma, San Diego, California (Wagoner 1989), and in the Point Loma Natural Resources Management Plan (Southwest Division 1993). A synopsis of those regulations that pertain specifically to heron protection and management follows.

Federal Protection

- Public Law 85-624, Fish and Wildlife Coordination Act: Assures that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development. - Pertinent to any actions affecting aquatic habitats used by herons on Point Loma.

- Public Law 86-797, Fish and Wildlife Conservation and Military Reservations (Sikes Act): Applies to all Navy Commands and personnel and covers naval installations and facilities located in the United States that contain land or water suitable for conservation and management of fish and wildlife resources. - Requires wildlife management to be integrated into a balanced multiple-use program, and requires cooperative planning with federal and state fish and wildlife conservation agencies.

- Public Law 89-669, Fish and Wildlife Conservation Act: Provides for conservation, protection, restoration and propagation of certain species including some migratory birds. - May apply to management of herons on Point Loma, as both species under consideration are migratory.

- Public Law 91-190, National Environmental Policy Act of 1969 (NEPA): Outlines responsibilities of the Federal Government for protecting various environmental qualities, and requires detailed assessment of potential impacts by any major action taken on Federal Lands - Any Environmental Impact Study on Point Loma would of necessity have to consider potential effects on heron habitat.

- Public Law 92-500, Federal Water Pollution Control Act: Requires permits to be acquired prior to any pollution discharge. - May apply where discharges effect heron habitat or food items.

- Public Law 93-452, Conservation and Rehabilitation Program on Military and Public Lands: Amends PL 86-797 by providing for wildlife-habitat improvement. - May provide legislative framework for improvement of heron habitat on Point Loma.

- Title 16 USC 703-711, Migratory Bird Treaty Act of 1918: Established a Federal responsibility for protection of the international migratory bird resource, including regulations controlling taking of migratory birds, their nests, eggs, parts or products, and provides enforcement authority and penalties for violations. - Perhaps the most significant regulation constraining activities that adversely affect herons on Point Loma.

- Executive Order 11990, Protection of Wetlands: Directs all Federal agencies to take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. - A broad ranging regulation that could apply to any actions affecting aquatic heron habitat on Point Loma.

- DoD Directive 4700.1 of 6 November 1978, Natural Resources Conservation and Management (NOTAL): Provides for management of renewable natural resources on military lands. - Provides framework for heron management on Point Loma.

- OPNAVINST 5090.1 of 26 May 1983, the Department of the Navy Environmental and Natural Resources Protection Manual: Provides guidelines and specifies responsibilities for the administration of the Navy program for the protection of the environment and conservation of natural resources. - An overview document that clearly includes mandates for preservation of resources such as the heron habitats on Point Loma.

State Protection

- State Code 1600-1606, Streambed Alteration Permits: Requires negotiation of agreement if stream or wetland will be affected, requiring "no net loss" of wetlands. - Could restrict actions affecting aquatic habitat of herons on Point Loma.

- California Endangered Species Act and State Code 2081: Provides for possible mitigation agreements if actions adversely affect endangered species or their habitats. - Heronries are protected under this legislation (Species of Special Concern List), which likely affects Point Loma.

Conservation Organizations and Public Interest

Community relations and environmental enhancement projects are considered a key element of activities in the Point Loma Complex. Several local environmental organizations have an interest in stewardship and protection of the Point Loma heron colonies, including the Sierra Club, Project Wildlife, and the Audubon Society. The National Audubon Society has published the "Blue List" of bird species for which concern is warranted. The Great Blue Heron was placed on the Blue List for the years 1980, 1981, and 1982 (Tate 1982). The primary area for which the concern was expressed was in the Midwest, from Minnesota to Ohio and Missouri. The species was subsequently dropped from the Blue List when indications of recovery in that area were noted.

Because both species of herons nesting on Point Loma are large and conspicuous, and herons in general are attractive to the public, maintaining and preserving the nesting colonies is a highly visible means for the Navy to demonstrate its commitment to natural-resource management and preservation. Likewise, failure to protect the colonies or outright destruction of heron habitat would probably result in highly negative media attention to the responsible Naval Command.

MANAGEMENT ISSUES FOR THE NAVY

Long-term management for the well-being of heron habitat on Point Loma will require ongoing consideration within several Naval areas of activity. This management will necessarily constrain some activities. In addition, the presence of the heron colony also poses some practical problems for base personnel. These questions are addressed below.

Development and Maintenance

One of the key elements for the long-term management of heron habitat on Point Loma is the recognition that essential habitats must be preserved and protected. Most importantly, nesting habitat must remain available. Ideally, this would include both artificial and "natural" nesting opportunities for the birds. In addition, roosting and foraging areas on Navy property need to be identified and preserved to the greatest extent possible. When sites are considered for future development, the location and architecture should reflect attention to real or potential effects on the heron habitat. Routine maintenance (*e.g.*, tree trimming or building painting) should also be scheduled to avoid adversely affecting the herons or their habitats.

Activity Restrictions

Any novel outdoor Naval or civilian activity should be examined for potential negative

impacts on heron nesting, roosting. Although the herons generally become accustomed to most human activities, unusual activity or activity too close to nesting, roosting, or foraging sites could be detrimental. Specific areas of concern are addressed in the Threats section of this plan.

Health and Sanitation Concerns

The most significant health and sanitation concern resulting from heron use of Point Loma centers on the herons' droppings. Many of the currently occupied colonies are in trees that border or are located within parking areas, or are near heavily trafficked streets, sidewalks, or buildings. We are not aware of any documented health threats to humans as a result of contact with such situations. Nevertheless, the droppings constitute a nuisance or inconvenience. Droppings can result in foul odors, slippery surfaces, and soiled cars, and therefore a need for increased maintenance. The droppings can also be detrimental to some ornamental landscape plantings. With time, and careful planning and implementation, most of these problems can be solved. Specific recommendations presented below address these concerns.

ACTUAL OR POTENTIAL THREATS TO NESTING COLONIES

Many threats to heronries have been identified in the literature, such as increased human activity, habitat alteration, land use changes, altered water levels, predation, pollution, and disease (Fruth 1988, Hjertas 1982, Butler 1992, Davis 1993). With proper management, these threats at Point Loma can be minimized.

Harassment or Human Activity

Human activity in the vicinity of heron nesting areas (people fishing under trees) has been reported to have caused increased nest desertion and abandonment in some rookeries (Page 1971), while visitor use (from 5 to 100 visitors observing from 230 meters) has been observed to

cause no signs of agitation or displacement in others (DeMauro 1993).

Agitation or displacement due to current human activity in the nesting areas do not currently appear to be a problem in the Point Loma heronry. This is likely due to a combination of the relatively high distance of the nests from the ground (minimum of 25 feet), the habituation of the herons to human activity, and their long association with this form of disturbance in the area over the past twenty years or more. Human activity at one of their feeding sites (the nearby bait barge) is tolerated to a distance of as little as 7 feet (V. Marquez pers. observ.). The herons do, however, temporarily abandon their nests during disturbances within the canopy of their nesting trees, indicating that equipment or human presence above ground is not tolerated and if continued for extended periods of time could result in egg or nestling mortality or permanent desertion of nests by adult herons.

Habitat Alteration

As previously mentioned, most undeveloped areas of Subase currently have development constraints. Two proposed projects, a new small-arms range at the intersection of McClelland Road and Myers Road and an engineering laboratory near the intersection of McClelland Road and Catalina Boulevard (Southwest Division 1993) are neither funded nor expected to be funded in the near future. This notwithstanding, these projects do not lie in areas of importance to Great Blue Herons or Black-crowned Night Herons.

Avoidance of changes in land use in the vicinity of the rookeries (as well as in existing and potential roosting and feeding areas) is recommended. If land-use changes are unavoidable, an undeveloped buffer with adjacent compatible land use (low disturbance levels) would be appropriate. The effective distance of these buffers would differ depending on the nature of the land use change, and would have to be determined on a case-by-case basis in consultation with knowledgeable biologists.

Road construction has been reported to affect nesting colonies negatively by lowering nest density and occupancy as well as fledging rates (Werschkul *et al.* 1976). Road construction during the 1980 breeding season around the Point Loma heronry resulted in lower fledging rates and a higher percentage of failed nests than during any previous year (Platter-Rieger 1981). We recommend minimizing construction and the use of noise-generating equipment as well as confining these activities to periods outside of the breeding season.

Altered Water Levels

Water-level variation is not expected to be a consideration for the Point Loma heron populations. However, since nesting site suitability is influenced by proximity to feeding areas, impacts to nearby feeding platforms should be avoided.

Predation

Predation of Great Blue Heron eggs by crows and ravens has been reported (Butler 1989). Nestlings have been reported to be preyed upon by raccoons (Hjertas 1982), eagles, Turkey Vultures, and Red-tailed Hawks (also in Butler 1992). Although raccoons have not been reported from Point Loma in the past (Advanced Sciences, Inc. 1993), they have recently been reported in the Cabrillo National Monument area, and their proliferation in the area is possible. High raccoon populations have been responsible for total reproductive failures leading to population declines and colony abandonment in the Qu'Appelle Valley (Hjertas 1982). The placement of 'raccoon guards' (large sheets of metal) around the base of rookery trees eliminated predation of eggs by raccoons. We recommend that raccoon guards be placed should predation by raccoons, feral cats, *etc.* become a problem. Although all of the aforementioned avian predators are known to occur on Point Loma (Advanced Sciences, Inc. 1993), and a Common Raven was seen on two occasions perched in the Black-crowned Night Heron nesting trees, predation does not currently appear to be a problem in the Point Loma heronry.

Contaminants and Pollution

Many bird species experienced decreased eggshell thickness coincident with the widespread use of organochlorine pesticides in the mid 1940's. DDE had the highest correlation with eggshell thinning; however, DDD, DDT, dieldrin, oxychlordane, cischlordane, and polychlorinated biphenyls (PCB's) were also shown to have significant correlations (Henny *et al.* 1984). Because herons are high on the food chain, nest colonially, and have such a wide distribution, the health of Great Blue and Black-crowned Night Heron populations is considered a good indicator of wetland contamination levels.

Great Blue and Black-crowned Night Herons have been the subjects of numerous studies on these contaminants (Fleming *et al.* 1984, Blus *et al.*1985, Burger and Gochfeld 1993 and , Henny *et al.* 1984, Henny and Blus 1986, Ives 1972), prompted by their being high in the food chain and feeding on medium sized fish that also concentrate contaminants in their fat. These herons have been used to assess levels of contaminants in aquatic ecosystems (Burger and Gochfeld 1993).

In 1981 and 1982, Blus *et al.* (1985) found low levels of Zinc (Zn), Copper (Cu), and Mercury (Hg) in Great Blue heron eggs in colonies 20 to 30 km from heavy contamination in Washington and Idaho. The concentration was apparently not high enough to induce mortality or affect reproductive success.

In Tennessee, Fleming *et al.* (1984) also found low concentrations of PCB's and chromium (Cr) in Great Blue Herons in four large colonies and Black-crowned Night Herons in three large colonies, concentrations below those associated with reproductive failure. However, they found DDE concentrations in some Black-crowned Night Herons to exceed levels associated with reduced nesting success. Since the number of nesting pairs in the colonies remained stable, they concluded that although some individual pairs might be experiencing reproductive failure, these numbers were not sufficient to cause a population decline. Average

eggshell thickness in 1980 was 7.5% less than prior to 1947 for the Great Blue Heron and 3% less for the Black-crowned Night Heron. Despite the lower percentage of eggshell thinning in the Black-crowned Night Heron, Fleming *et al.* found it to be more sensitive to DDE than the Great Blue Heron.

Burger and Gochfeld (1993) found Black-crowned Night Herons to have levels of lead, cadmium, manganese, and selenium higher than in four other species of herons. In 1978, 1979, and 1980 DDE was detected in all (n=220) Black-crowned Night Heron eggshells studied from eight populations in Washington, Oregon, and Nevada. The level of contamination in eggshells increased strongly toward the south. Eggshell thickness was negatively correlated with DDE and PCB residues. At DDE levels above 8 parts per million (ppm), clutch size and productivity decreased and the number of cracked shells increased (Henny *et al.* 1984). DDE or DDT contamination was found near only two of the eight breeding colonies (productivity reached below maintenance level in one of these populations), suggesting that the birds were exposed to different levels of contamination while on wintering their grounds. Further research (Henny and Blus 1986) found a significant difference in wintering locations of the highly contaminated and less contaminated populations. Individuals from the most contaminated population were found to winter in the southwestern United States (primarily southern California) and in the interior of northern Mexico, while individuals from the less contaminated population were found primarily in coastal Mexico. Since PCB's are industrial pollutants these results are consistent with expectations.

These data from other locations are presented in detail to illustrate the potential negative effects that contaminants and pollution can have on heron populations. Although no connection between contaminants in San Diego Bay and the Point Loma heron colonies has yet been established, concern is warranted. Deceased birds or non-viable eggs should be routinely examined for accumulations or effects of contaminants or pollution.

Disease

Although herons are susceptible to a variety of avian diseases and disorders (*e.g.*, Georgi *et al.* 1986, Locke 1961, Peters and Neukirch 1986, Wiese 1979), The only condition known to have significant impacts on the Point Loma colonies is yellow fat disease. Yellow fat disease is characterized by inflammation and fibrosis of adipose tissue (steatitis), extensive degeneration of the adipose cells (steatosis), and accumulation of lipofuscin pigment (Danse and Verschuren 1978). These syndromes have been linked to diets containing large amounts of polyunsaturated fatty acids resulting in an increased requirement for vitamin E (Van Vleet and Ferrans 1992). In addition to multiple yellow lesions in subcutaneous abdominal fat deposits, vitamin E deficiency can cause muscular weakness, anemia, severe congestion and edema in the lungs, serous transudate in the body cavities, necrosis of smooth muscle, lesions in the cardiac muscles, liver and pancreas, and stomach ulcers (Van Vleet and Ferrans 1992).

Although yellow fat disease is not widely documented in the literature as a threat to heron colonies, it has been responsible for a large die-off of Black-crowned Night Herons (Carpenter *et al.* 1979) in captivity (53% of 109 birds, over 10 weeks). Mortality followed a change in their diet from North Atlantic smelt to Columbia River smelt. Mortality was highest among young of the year, likely reflecting their lower tolerance of nutritional deficiencies.

Yellow fat disease has been reported at the Point Loma heronry since at least 1979 (Cosgrove, unpublished data). In recent years, it appears to be affecting the heron colonies at Point Loma significantly, especially those of Great Blue Herons (Platter-Rieger, pers. comm.). The source of this condition is currently unknown but is being investigated. A more detailed discussion of this problem is beyond the scope of this management plan, other than to note that the disease appears to be potentially devastating, and heightened investigation and attention to the problem should be one of the highest priorities for preservation of the colonies.

MANAGEMENT GOALS

Long-term management goals should incorporate strategies that result in the preservation and conservation of the heron populations on Point Loma. The primary goal of this management plan is to provide population stability. The best means to accomplish this goal is through clear, high-priority programs and policies to maintain habitat availability and quality.

Population Stability

The health and well-being of the heron populations on Point Loma can be determined only by long-term monitoring of the status and reproductive success of the breeding colonies. Upward trends in numbers of nests and fledglings will indicate apparently healthy populations; declining numbers are cause for concern and intensified investigation into causative factors.

Habitat Availability and Quality

In all likelihood, maintenance of habitat availability and quality will be the best means for preserving the long-term stability of the heron colonies on Point Loma. At present, nesting habitat does not seem to be a limiting factor to nesting. Sufficient large and tall trees are currently available to provide for healthy and stable populations. For long-term stability, care must be given to ensuring that the existing trees, many of which are mature and approaching senescence, are replaced with carefully located plantings of replacements. In addition, the herons' use of the recently installed artificial nesting platforms should be monitored as a practical supplement to the trees. Both replacement trees and artificial platforms should be situated to minimize disturbance and conflicts with other land uses.

The success of any nesting colony depends on the nearby availability of adequate foraging sites and roosting areas. Nearby undisturbed sandy shoreline and fixed or floating

platforms currently suffice, and many of the foraging and roosting areas are located outside of the immediate Point Loma facilities. Identifying these areas has been determined to be a high priority (Platter-Rieger, pers. comm.). Those areas on Point Loma determined to be important (at all seasons) should be maintained in a fashion that is compatible with heron use.

RECOMMENDATIONS

In addition to those recommendations included in the text of this plan, we suggest or reiterate the following approaches to maintaining the long-term viability of the Point Loma heron populations:

- Preservation and management of the heron populations is possible only with support from the highest command levels of the various facilities on Point Loma, and communication between these commands regarding activities that could adversely affect the herons should be a high priority.

- Ongoing monitoring of nesting locations, phenology (timing) of nesting, reproductive effort, and success is essential to evaluation of the well-being of the populations and the results of any management activities.

- Artificial bathing or supplementary feeding pools should be considered as a means to attract birds away from disturbance or nuisance areas. Careful monitoring of any supplemental feeding is critical because rancid or spoiled fish and induce yellow fat disease.

- Any development or maintenance planning or activity on Point Loma should consider potential effects on the heron populations, especially if those activities include any possible alteration of heron habitat.

- Long-term landscape planning should be undertaken with the ultimate goal of not only providing suitable adequate nesting habitat for the birds but also with the goal of reducing land-use conflicts. The colonies currently despoiling parking and human use areas may be relocated very slowly by creation of nearby alternate nesting sites and incremental elimination of those trees located in problem areas. This approach should be undertaken under the guidance of a knowledgeable biologist and should include an experimental period followed by careful analysis of the relocation efforts.

- Investigations should be undertaken or continued to identify critical factors in heron breeding success, including availability of suitable habitat, food supplies, contamination, and possible sources of the yellow fat disease. In addition, since prey fish are often attracted to lighting over water, this facet of feeding ecology should be investigated to determine its importance to herons, and no broad-scale changes in lighting patterns should be made until the potential impacts are understood and analyzed.

- The impact of heron droppings on parked cars could be lessened by construction of parking covers or shelters in affected areas.

- An education and interpretive program should be undertaken to provide information to military and civilian personnel on Point Loma regarding these important heron colonies and their wildlife value. Many opportunities exists for this kind of education, including interpretive signs and kiosks, incorporation of colony status information in regular periodical publications, nature walks, press releases, and a variety of other means.

- The program of banding juvenile herons at nests, first undertaken in 1995, should be continued to better understand the population demography of the nesting colonies. Only through this method can critical information such as dispersal, recruitment, population age structure, home ranges, survival, foraging and general ecology, competition, and

longevity be understood and incorporated appropriately into planning, management, and conservation efforts.

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These volumes include the Natural Resources Management Plan, Appendixes A-K (Volume 1), Appendixes L-N (Volume 2), and Appendix O (Volume 3). The information covered includes contractor surveys of common and sensitive plants, animals, and insects, as well as an extensive collection of photographs documenting natural resources and mitigation work occurring on Naval Submarine Base, San Diego, from 1990-1996.

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